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10 JULY 1986

# USSR Report

MILITARY AFFAIRS

AVIATION AND COSMONAUTICS

No 3, MARCH 1986

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USSR REPORT  
MILITARY AFFAIRS

AVIATION AND COSMONAUTICS

No. 3, March 1986

Except where indicated otherwise in the table of contents the following is a complete translation of the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow.

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## YOUNG FIGHTER PILOTS DESTROY TARGET DRONES, QUALIFY FOR ALERT DUTY

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 4-5

[Article, published under the heading "Alert Duty -- A Mission of National Importance," by Lt Col A. Vesnov: "'Hoist the Flag!...!']

[Text] Preliminary preparations were completed, the squadron commander had left for regimental headquarters to report, while the pilots had remained behind in the classroom, waiting for the bus to drive them over to the base. Lts Nikolay Berezkin and Mikhail Udaltsov were over in a corner debating some point.

"Cut the philosophizing!" Udaltsov exclaimed heatedly. "State specifically what aircraft you have in mind: a fighter, a ground-attack aircraft, or a bomber."

"Well, let's say a fighter," Berezkin replied with restraint. "It is flying at an altitude, let's say, of 15,000 meters on this heading." Nikolay grabbed a sheet of paper and quickly roughed out with a felt-tip pen a diagram of an air situation. "Here is the defended installation. Here is the airfield, and here is the designated intercept point. You can make calculations if you want."

Udaltsov took a sheet of paper and proceeded to make calculations. From time to time he would briefly reply to remarks by his comrade.

The young pilots were "battling" with increasingly more enthusiastic excitement, and they gradually became the focus of everybody's attention. Even the imperturbable Senior Lieutenant Tverdokhleb turned toward the noisily-engaged lieutenants.

Udaltsov was enthusiastically constructing rows and columns of formulas and numbers on his piece of paper. He would whisper softly to himself, covering his eyes, and then would continue writing. Berezkin gazed silently at his comrade and smiled slyly. His face gave away his thoughts: "Calculate until you're blue in the face, and then I'll give you another scenario change!"

After several minutes had passed, Udaltssov triumphantly completed his calculations. Berezkin frowned suspiciously and leaned over toward the diagram.

"How about guidance mode?"

"Here you are!" Udaltssov underlined the appropriate line on the sheet of paper.

"How about aspect?"

"Four fourths!"

"At that speed? What about maximum allowable missile G forces?"

A triumphant note crept into Berezkin's voice. He was obviously expecting to deliver the coup de grace on his comrade, as he had failed to spot the required figure in the notes.

"At the limit, but adequate," confidently replied Udaltssov.

"I'm not so sure," Berezkin skeptically shrugged his shoulders.

"I did the calculation in my head.... If you have any doubts, check it. Here are the final figures."

And Udaltssov jotted down several numbers.

"Can you beat that.... The guy is a walking computer," commented one of the pilots.

"You guys are of course doing a good job of combat. But I do not quite understand the purpose of your mental gymnastics," commented Tverdokhleb with a somewhat condescending air.

He had graduated from service school two years prior to Udaltssov and Berezkin and sometimes, seemingly quite innocently, would remind them of this fact. Particularly since now he was serving as acting flight commander, and for this reason he went on: "We are preparing to fire at a specific target. We know its parameters and characteristics. And we should proceed from this point. Your amateur-night efforts are totally useless. You would do better to take another look at your flight calculations."

The two lieutenants exchanged glances.

"We have completed all the preparations, said Berezkin in a somewhat less than firm voice. "But we are preparing not only for weapons delivery...."

"What else are you preparing for?" replied Tverdokhleb, raising his eyebrows in surprise.

"For alert duty," stated Udaltsov, for some reason with a note of pride in his voice, and then added somewhat tentatively: "After we finish at the range, shouldn't they certify us to stand alert duty?"

Tverdokhleb obviously was not expecting such a statement. He cleared his throat and then, with his former tone of voice, intoned the conclusion: "Tomorrow at the readiness check we'll see about whether 'everything has been done'...."

"There is no need to fear the readiness check, Comrade Tverdokhleb," the squadron deputy commander for political affairs, Major Panteleyev, who had walked into the classroom, suddenly interjected into the conversation. The door was open, and therefore nobody had noticed him. "You too, lieutenant, are not entirely correct. We are preparing not only for alert duty but also for actual combat operations if necessary. and our daily training missions are focused on preparing for combat. Understood?"

The major sat down behind the desk and invited all the officers to do likewise.

"Present times are such that every day it is necessary to work on self-improvement, for otherwise one will fall behind. From this standpoint as well the lieutenants are in my opinion proceeding correctly. Of course, they are completely ready for the flight." Panteleyev peered intently at Udaltsov and Berezkin.

"Comrade major, we are ready to be checked right now!" the heartened Udaltsov enthusiastically chimed in.

"The point of course is not testing readiness," Panteleyev went on. "Charts, diagrams, engineering and navigation calculations are not everything. It is important to understand why you need weapons practice. And of course one needs the will to win."

"But we've got it, comrade major!" Udaltsov again emphatically exclaimed.

"That we shall see out on the range," replied Panteleyev.

"Do you know when we're taking off?" Berezkin guardedly asked.

"Those times are past when the adversary would give warning: 'I'm going to treat you with courtesy!....'"

Berezkin was seized by a strange feeling. The words spoken by the deputy commander for political affairs had created some inner tension. It was not like they contained anything new, particularly since he himself knew why he had enrolled in service school and was aware that fighter aircraft do not take to the skies for the sake of pleasure junkets. But he had not sensed this feeling so acutely in the past. There had been the feeling of excitement in mock battles and the novelty of first flights. But this was something different. A few days ago when he had visited the alert shack, housing the alert-duty flight, and had watched the commencement of alert duty ceremony, he

had come to a realization of his own involvement in a great, very important cause -- defense of the homeland. Naturally what the deputy commander for political affairs had said today took on special significance.

"Prepare for combat!" Words filled with impact and significance.... How could he not have realized this sooner? It was as if a curtain had opened up before him, and Nikolay sensed what responsibility he bore on his shoulders for everything he saw below him while aloft. Down there below were his mother, his father, his little sister.... Millions of people! Would his wings be sufficient to shield them securely against all dangers? Because very soon he, Lieutenant Berezkin, would be entrusted to stride across the threshold of the alert shack -- to take his position on the front line, to guard our airspace with combat weapons!

The signal to assemble sounded while they were checking readiness. Events moved swiftly. Soon Udal'tsov and Berezkin were at the other airfield. Everything looked different here: mountains along the horizon ringing the base, the pitch blackness of the southern night, the serious expressions on the faces of the unfamiliar technicians [crew chiefs] who were waiting for the aircraft at the flight line parking spaces, and even their own mood, as they waited in anticipation of something even more substantial and significant. From the very first moment after he had taxied to the ramp, Nikolay Berezkin could not shake the sensation that an unseen enemy lurked somewhere out there in the skies and that it was up to him to intercept that enemy. But for some reason the scramble command was not given.

Everything was somewhat different than Berezkin had imagined. The schedule, the precise sequence of training sorties, and a target assigned to each pilot. but soon he came to realize that this was merely an external similarity with normal training flights. The psychological mood of readiness for combat, to destroy the "adversary" stayed with Nikolay.

When a target blip appeared on his weapons radar, he literally pinned it with his gaze. Awareness of the fact that this could well be a real enemy, that he was carrying a real missile, tensed him to the maximum.

Just as Nikolay placed the lock-on strobes on the target blip, it suddenly moved laterally. "He is maneuvering!" the thought flashed.

A dexterous manipulation of the control stick, and the blip was again at the center of the screen. Lock-on! Months of combat training were reflected in these precise movements.

"Missile away!"

Up to this point Nikolay had seen the target only as a blip on his radar. But he now took his eyes off the instruments and looked forward through the windscreens. He focused his gaze on the bright flame from the missile which had shot out from under his wing. The target had to be somewhere out there ahead of him. An instant later Berezkin saw the subdued flash of an explosion and fragments of the target that was no more. Once again Nikolay found himself entertaining the thought that this could have been a menacing bomber

carrying a lethal cargo which it was about to let fly onto the peaceful Soviet land.

Udaltssov had already flown his sortie and was waiting on the ramp for Nikolay's aircraft.

"Attaboy! Congratulations!" he literally dragged his friend down the ladder and enveloped him in a crushing embrace. He was still immersed in his own thoughts, and Mikhail, as if fearing that he would be interrupted, began a rapid-fire account: "You know, I locked him on and then lost him. I thought that was it! But then I figured how to anticipate his maneuver. Then I locked him on again! After that, you know, the missile took over...." Mikhail sighed in relief.

Panteleyev strode up, halted Berezkin's verbal report with a wave of his hand, and asked him with a smile: "Well, Berezkin, what were you thinking about just before you attacked?"

"About victory, comrade major!" the pilot answered with a serious mien.

"A philosopher," Udaltssov shook his head.

"And did you remember your formulas?" Tverdokhleb said jokingly.

"What do you mean formulas!" Mikhail exclaimed. "I wouldn't have even been able to remember my own name if somebody had asked. But the interesting thing is, my hands remembered everything by themselves, acting before I even figured out what was happening. It seems those hours on the simulator were beneficial."

This brought a friendly laugh on the part of the pilots and maintenance technicians surrounding the aircraft, and Panteleyev said in conclusion: "It is called the skill of habitual response. By the way, I should congratulate the two of you on another matter."

"What matter, comrade major?" Mikhail asked, casting a perplexed look at Nikolay.

"Well, what what do you think? You have now qualified to stand alert duty."

"Right after we get back?" Udaltssov asked impatiently.

"As soon as you are officially named in an alert-duty order," Panteleyev added.

The order came out a week later. The following morning, immediately after reporting for duty, Nikolay looked in at headquarters, where the names of pilots were written in chalk on a blackboard divided up into columns, under the heading "Alert-duty roster." Udaltssov was already there. He had to make it look like he had come on an entirely different matter, but nevertheless he was able to determine with the corner of his eye that his name did not appear on the blackboard.

During the course of the day he paid several visits to headquarters, but to no avail. Finally that evening, when he had decided to take one more look, he encountered Mikhail in the hallway of the training facility.

"They have posted the new alert-duty roster," reported Udaltsov. "You're on it."

Berezkin was flooded by a wave of emotion. He barely was able to force himself to wait a moment, and then asked, trying to stifle a smile: "What about you?"

"Not at the moment. I believe my turn will come soon, however. Anyway, congratulations."

Berezkin did manage to drop into headquarters just before supper. Having just come off the street and from the bright light in the hallway, the duty roster board was somewhat hard to read, but Nikolay managed to make out in the third line from the top: "Lt Berezkin, N. P." So, tomorrow he would stand alert duty for the first time in his life, guarding the peaceful skies of the homeland. That is precisely how the order is worded. It was crystal clear, but he could not tear himself away from this board or his gaze from that long-awaited name entry.

Nikolay turned in early that night. Although he always woke up on time on his own, this time he set the alarm. He had long since become accustomed to rising early and riding out to the field for flight training. This morning, however, everything took on added significance: departure for the airfield in a bus specially for alert-duty aircrews, the physical examination, arrival at the alert-duty flight's ramp area, fueling his aircraft and, finally, the solemn ceremony which involved reading aloud the commencement of alert duty order, and raising the air flag to the accompaniment of the National Anthem.

...Essentially nothing out of the ordinary took place during alert duty. No alert sounded, and they did not scramble to intercept an airspace intruder. In short, alert duty passed in a routine manner. Nevertheless something imperceptible but new and important had come into the life of this young pilot.

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## NOVOZHILOV CARRIES ON ILYUSHIN AIRCRAFT DESIGN TRADITIONS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 6-7

[Article, published under the heading "About Delegates to the 27th CPSU Congress," by Col V. Lebedev: "Chief Designer"]

[Text] One day in January 1981 a new widebody Il-86 airliner lifted off the concrete runway at the airport in the capital of Uzbekistan, inaugurating regular air service between Moscow and Tashkent. The unique aircraft had been developed under the direction of now Academician G. V. Novozhilov, twice Hero of Socialist Labor, Lenin Prize recipient, and deputy to the USSR Supreme Soviet.

We were returning from Tashkent on this flight. We waited impatiently for the boarding announcement. We were naturally nervous: how would the flight turn out? After all, the giant aircraft had just been put into long-route service and was in fact just getting broken in.

I remember with what nervous excitement we approached the giant airplane's boarding steps. We had never flown on such an aircraft. It is true that many of us had on numerous occasions flown on aircraft built by the "Ilyushin Company": the Il-12, Il-14, Il-18, and the flagship of Aeroflot, the Il-62. And now we would be flying on the Il-86 airbus.

There was no delay with the boarding process. There were three sets of boarding steps, which passengers leisurely climbed and entered luxurious, brightly-lit passenger cabins accommodating 350 persons, and took their places in the comfortable seats. We were airborne after a short takeoff roll. The passengers felt no shaking of the aircraft and heard no irritating noise from the smoothly-running engines. Everybody was comfortable: both adults and children. Our neighbors were a young married couple with a baby less than a year old. A solicitous flight attendant immediately offered the parents a suspension cradle. It kept the little fellow quiet as a mouse during the entire flight.

"Luxurious comfort. This airplane has a great future," my neighbor commented on the "86" as we were descending the boarding steps upon landing at Moscow's Vnukovo Airport.

Here are some figures. In five years the giant Il-86 aircraft has carried 12 million passengers. It flies to dozens of countries throughout the world.

Design offices were small in the early years of aviation. As a rule they consisted of a senior design engineer, two or three assistants, a production engineer, assembly supervisors, draftsmen, and production workers. Testing involved the services of ground specialists and test pilots. Design offices began to expand as aviation rapidly advanced. In spite of this fact, the role of chief designer always has been and continues to be very important. The reliability and longevity of designed aircraft depend on his profound engineering intellect, initiative, and innovativeness. He makes all the main decisions, selects the most effective and efficient engineering principles of aircraft construction, wields influence on the suppliers, and bears responsibility for the quality of the work done by the enterprises and organizations subordinate to the special design office.

The design office which bears the name of Sergey Vladimirovich Ilyushin is carrying on its finest traditions in a worthy manner. I am not exaggerating when I say that one can trace the history of development of world aviation in the last half century in aircraft bearing the Il logo. The members of the Ilyushin team, now under the direction of gifted aircraft designer and able organizer Genrikh Vasilevich Novozhilov, have made a substantial contribution to this great cause. They continue today to occupy their rightful place in the vanguard of scientific and technological advance and are giving our homeland first-class airliners of various types and designations. Many people wonder why it is that Ilyushin aircraft are so long-lived and leave a deep imprint in the consciousness of those who have gone to war with them and those who fly them today as pilots or passengers.

Genrikh Vasilevich Novozhilov comments: "Ilyushin considered the main thing in his work to be better accomplishment of that task and attainment of that goal for which a new aircraft was being developed."

Genrikh Vasilevich went to work as a designer in the famed special design office in 1948. In the postwar period the development of jet aircraft was rapidly picking up pace. It was presenting tough problems not only to the designers of combat aircraft but those of transport aircraft as well. The special design office had to prepare for and carry out highly complex scientific research experiments. An innovative attitude and the ability to look into the future was required of the design team.

"It was difficult to feel immediately that one was a full-fledged member of this famed team and to fall into the rigid production rhythm," recalls G. V. Novozhilov. "The first thing that was readily apparent was the very strict discipline, work intensity, and an understanding of the assigned tasks and responsibility on the part of each and every individual and the special design office as a whole for accomplishing them. I soon realized how a well-oiled mechanism operates, in which each individual knows his place, his job, and when his work is expected to be completed...."

The labor of an aircraft chief designer cannot be measured in work hours or a specific segment of time. Each and every day in his life is filled to the limit. He is concerned with that aircraft in the actual development process, as well as those models which have been conceived for the distant future. And while being concerned with the future, he is also concerned to ensure that these aircraft are in conformity with the spirit of the time and with the level of development of aviation in the leading countries of the world, that they be reliable, economical, and easy to fly and maintain.

The Ilyushin team always sailed a true course toward the stated goal and was distinguished by total commitment, innovativeness and creativity, a high degree of organization and smooth coordination in its work, as well as a strong sense of responsibility to the people and the Leninist Party. It was always distinguished by flight of imagination grounded on thorough knowledge and precise calculation. This is what enabled the special design office to ensure dependability, safety, simplicity, and sophistication of design to their aircraft. And that which later became obvious would require enormous labor, diversified knowledge and profound analysis.

"At the same time," noted Genrikh Vasilyevich, "every aircraft advances new problems as it is being designed, including those which can be predicted, but more frequently those which arise in the process of design, testing, and even operational use. The solution to each such problem is a tiny part of the life of a chief designer. This demands that he possess talent, great knowledge, courage, composure, immense energy and, of course, the ability to work with and lead others.

The people at the design office still remember a statement by Sergey Vladimirovich Ilyushin: "It is incomparably more difficult to create a capable and efficient team of like-minded, enthusiastic individuals than to design the very finest aircraft. But such a team has been created."

The pride of the design office is the Il-62 intercontinental airliner. Inauguration of direct air service between Moscow and New York with this aircraft demonstrated the capability of Aeroflot to compete with the international air carriers in overseas service and on difficult routes. The Il-62 passenger jet is a qualitatively new achievement and is highly regarded abroad.

During the final phase of development of this aircraft, Sergey Vladimirovich Ilyushin and Genrikh Vasilyevich Novozhilov visited England with a group of Soviet specialists. Upon visiting a plant at which a British aircraft with a similar engine configuration was being built, they carefully examined an aircraft in the assembly shop, compared it with their own aircraft, and asked their British colleagues a great many questions.

More than 20 years have passed since the Il-62 jetliner was displayed at the Paris Air Show, and somewhat later at the air show in Turin. Wherever it went, it drew numerous visitors, who had very nice things to say about this luxuriously appointed aircraft. Its appearance in Turin evoked considerable comment in the world press. It was noted in particular that the Il-62 aircraft is stable in flight, shows no tendency to shake or vibrate, and with

almost no engine noise audible. The director of the Turin Air Show confessed: "I am enraptured by this mighty ship!"

Work on designing the Il-62 was good training for Novozhilov prior to becoming chief designer in a famed special design office which for more than half a century had been occupying a leading position in Soviet aircraft engineering.

There are no boundaries limiting the designer's flight of thought. One cannot, however, endlessly retool regular production plants for each new aircraft, put costly industrial processes into regular series production, or ignore the production capabilities and opinions of an aircraft's future builder. At the special design office they are constantly thinking about economy and efficient utilization of the material and financial resources allocated by the state, as well as manpower resources. These principles were laid down by S. V. Ilyushin, who was a farsighted leader. He knew the value of and carefully husbanded public monies. It is for good reason that Ilyushin aircraft designs won widespread recognition at aircraft manufacturing plants for their excellence of engineering and manufacturability.

"We might recall Sergey Vladimirovich's suggestion of a sectional wing for the Il-28 bomber," stated Genrikh Vasilyevich. "A highly complex piece of equipment now possessed greater aerodynamic efficiency. It became possible to assemble it separately from the aircraft proper. This broadened the aircraft assembly work front and sped up the assembly process. This enabled the manufacturing plants to reduce the cost of the Il-28 bomber to that of a fighter."

The designer should also perform the functions of a production engineer: he should not only come up with a design but also know how to do it simpler, cheaper, and better. That same sectional wing, jigs without conventional cutters in assembling the fuselage of the Il-62 -- these are all creative solutions in production process, innovations, an example of expert handling of a complex technical problem. They reaffirm faith in the workforce of the regular production plant and its specialist personnel....

The entire creative and multifaceted design activities of Genrikh Vasilyevich Novozhilov are inseparably linked with this special design office. He came here after graduating from the Moscow Aviation Institute imeni S. Ordzhonikidze and began as a design draftsman. He worked hard. His hardworking nature and talent were noticed. Soon Genrikh Vasilyevich was promoted to a supervisory position. By 1964 Novozhilov was senior designer and first deputy to the Chief Designer. He was handling engineering and technical supervision of the Il-18 operational support program, and subsequently was in charge of flight testing and adding finishing touches to the Il-62 jetliner. Ilyushin subsequently placed Novozhilov in charge of the Preliminary Design Office, which he always had himself headed.

During this period Genrikh Vasilyevich designed the Il-76T aircraft. This marked the beginning of Novozhilov's independent design activity. It was designed to haul freight in medium and long-route service.

The Il-76T is a member of the new generation of cargo-haulers designed to replace turboprop aircraft. It is characterized by an increased payload capacity, greater speed and range. Excellent basic performance characteristics, including takeoff and landing performance, ensure the 76 good operating economy. In addition, a new avionics package gave it reliable capability to fly day and night, year-round, on difficult routes, and in various climatic and weather conditions.

The Il-76T can haul large-size cargo, all types of manufactured goods, buses, agricultural equipment, large-diameter pipe, as well as all types of air, ship, and rail freight containers. Its cargo cabin is equipped with devices mechanizing laborious loading and unloading processes. They shorten the Il's on-ground idle and servicing time.

But the special design office headed by Academician Genrikh Vasil'yevich Novozhilov is proceeding with new plans and projects.

"Currently in the process of designing new aircraft," states Genrikh Vasil'yevich, "the special design office is keeping pace with scientific and technological advance, incorporating a great many vanguard ideas both in an aircraft design and into the method of producing a design."

The Special Design Office imeni S. V. Ilyushin is currently working on the Il-96, a long-range mainline passenger aircraft. It is designed to carry 300 passengers, baggage, mail and freight in long-route service -- up to 9,000 kilometers. Plans calls for operating it on international routes up to 11,000 kilometers. It will enter service with Aeroflot in the 12th Five-Year Plan.

Externally the new aircraft will be similar to the Il-86. In actuality the Il-96 is a totally different aircraft. Everything about it is qualitatively new, significantly improving the aircraft's performance characteristics, operating economy, and easing the crew's work load on a long flight.

The design team has begun work on the Il-114. This passenger aircraft is intended for local air service and is designed to carry 60 passengers on routes extending up to 1,000 kilometers.

We can be assured that the special design office headed by Chief Designer Academician Genrikh Vasil'yevich Novozhilov, delegate to the 27th CPSU Congress, will continue in a worthy manner carrying on the finest traditions of the "Ilyushin school" and will gladden our homeland with new aircraft in the 12th Five-Year Plan and beyond.

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## INNOVATIVE HEAD OF TRAINING REGIMENT AVIONICS MAINTENANCE GROUP

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 9-11

[Article, published under the heading "Implementing the Decisions of the 27th CPSU Congress," by Lt Col V. Larin: "Purposefulness"]

[Text] Implementing the decisions of the 27th CPSU Congress, the aviators of the excellent-rated training regiment of the Order of Lenin Yeysk Higher Military Aviation School for Pilots imeni Twice Hero of the Soviet Union Pilot-Cosmonaut USSR V. M. Komarov are working today with enthusiasm and inspiration. The party organizations of the unit's subunits are doing a great deal of work aimed at achieving high results in military labor. By impassioned party word and personal examples, Communists are inspiring their colleagues to storm the heights of combat expertise.

It was growing dark. Things were unusually quiet in the maintenance unit's spacious hanger and lab building. At such moments, when the workday has ended and the atmosphere has become more relaxed, it is particularly pleasant to go over in one's mind the events of the day.

Capt Yu. Gayvoronskiy was sunk in thought. His maintenance group's specialist personnel had done a fine job. They had fully met their work target. He was the only one who had not yet finished up....

Suddenly the door creaked -- the subunit ramp area duty man appeared in the doorway.

"Excuse me, captain, but it's time to turn the hangar over to the guard detail," he reminded Gayvoronskiy.

"Yes, yes. I'm going." Gayvoronskiy stood up and quickly gathered his tools together. He cast a regret-filled glance at the uncompleted circuit board: he would have to postpone it to the following day.

Yuriy Ivanovich strode along the familiar path toward the lights of the base compound twinkling off in the distance. His wife would most probably be

waiting impatiently for him. Perhaps a letter had arrived from his son -- Oleg had recently graduated from a higher aviation school for pilots. "He has become the third officer in our family," Yuriy Ivanovich thought to himself with satisfaction.

Military service had taken Gayvoronskiy to various parts of the country, and he had served abroad as well. And he, an aircraft maintenance specialist, had moved around quite a bit to different duty stations. He had handled every new duty assignment in an exemplary manner. It was not his way to do otherwise. He was forced to do so by his duty as a Communist and his honor as an officer. He had steadily grown as a maintenance specialist, supervisor and instructor of his subordinates, and as an efficiency innovator. This officer is currently in charge of an aircraft inspection and maintenance group. He also has substantial duties to perform as a member of the subunit party buro.

Master proficiency-rating Capt Yu. Gayvoronskiy had joined the pilot training regiment's maintenance unit four years back. He took over the avionics maintenance group. The majority of the specialist personnel were experienced, but they were lacking a unifying goal which would give composure and purposefulness to their actions. Yuriy Ivanovich defined such a goal: for the group to earn the title of excellent by the end of the training period. He talked with the men and focused Communists and Komsomol members toward achieving this cherished goal. Some he convinced by persuasion, and others he helped gain confidence in their own abilities and in the capabilities of the team. The party and Komsomol groups gave him solid support in accomplishing the tasks facing them. The officer himself worked without pause, as they say, nor did he give the others an easy time of it. The flame of competitiveness was burning with increasing brightness in this group.

The stated goal was achieved. For more than 3 years in a row now the avionics maintenance group has been confirming its rating of excellent. A good deal of credit for this unquestionably goes to Captain Gayvoronskiy.

Yuriy Ivanovich's party-minded approach to the assigned task and his fine organizer abilities were contributing factors when the technical maintenance unit party members elected the new buro at the party report and election meeting. Gayvoronskiy was unanimously elected secretary. He was reelected the following year. For 3 years in a row he headed the subunit party organization.

Party member Yu. Gayvoronskiy has done a great deal to ensure that the technical maintenance unit party organization became a genuine support and right-hand man to the leader-Communists in accomplishing combat training tasks, ensuring flight safety, training and indoctrination of ideologically conditioned specialist personnel who were excellently prepared both militarily and professionally. He is characterized by precision and a high degree of organization in his work.

At one time unfavorable criticism was leveled at Warrant Officers N. Kurgan and S. Dremlyugin, who had committed breaches of discipline. Gayvoronskiy looked into their activities, their interests, how they spent their off-duty time, and helped them gain a better understanding of their capabilities,

future prospects in the military and their personal responsibility for the subunit's affairs. Of course others also worked with them, but Gayvoronskiy is without question to be credited for the fact that both took to the straight and narrow and found their place in the military collective.

He also accomplished a great deal to ensure uninterrupted supply of various spare parts items to the technical maintenance unit. Yuriy Ivanovich sought to accomplish psychological reorganization on the part of his fellow soldiers, particularly party members, during transition to new inspection and maintenance techniques, and he himself displayed an example in this. There are perhaps no items in the collective's life and activities in determination of which party member Gayvoronskiy would not have made his contribution as a party activist.

Implementing the party's instructions pertaining to further strengthening combat readiness, the Communists of the technical maintenance unit seek to keep pace with practical realities, assisting subunit leader personnel with deeds rather than words alone in improving servicing inspection, repair and preventive maintenance in the work process, increasing activeness, developing creative inquiry on the part of innovators, and rapid practical adoption of all valuable suggestions and advanced methods of organizing military labor.

"At almost every meeting or party buro session our Communists discuss ways and means of further development of efficiency innovation work in the technical maintenance unit and involvement of as many people as possible in technical innovation," states Capt Yu. Gayvoronskiy.

In fact, innovative inquiry in servicing equipment and good training facilities are an important condition for effective, high-quality teaching of professional expertise to maintenance specialist personnel. Technical innovations by efficiency innovators comprise a reserve potential for achieving savings in materiel, time and labor. In the final analysis this has a beneficial effect on increasing the subunit's combat readiness and helps boost it to a higher level.

Yuriy Ivanovich waxes enthusiastic when he talks about efficiency innovation work. One senses that this topic moves him profoundly. He himself has long been working on the development of new and improvement of existing instruments, devices, and tools. As an experienced maintenance specialist and one of the leaders of the party collective, he sees with particular clarity the genuine benefit to be derived from practical adoption of the efficiency innovation suggestions of technical maintenance unit personnel.

"Take the following example," states Yuriy Ivanovich. "Formerly it took a good amount of time to repair a communications transceiver with replacement of crystals. Now we use test equipment we ourselves devised to check crystals without unsoldering them from the printed circuit board. The entire operation takes a few minutes...."

Every year technical maintenance unit efficiency innovators adopt dozens of valuable innovations. The minutes and hours saved are used to accomplish higher-quality checking and testing of equipment at so-called bottleneck

points as well as, an item which is very important, for further training of maintenance specialist personnel, including novice efficiency innovators. Periods of rush work and frayed nerves have been eliminated. Labor productivity has increased.

"But a great many problems have not yet been solved," stated Capt Yu. Gayvoronskiy. "One of them is that of involving young technicians and mechanics in innovation inquiry. At the present time the technical maintenance unit is accounting for approximately two thirds of all efficiency innovation suggestions in the regiment. Seems like a decent figure. But who are the authors of these innovations? The same Sokol, Rybalchenko, Shmelev, Blyank, and several other of the most experienced maintenance specialist personnel with a great many years of work experience. But we must develop a new generation of innovators and expand innovator ranks. It is gratifying that the young people are showing an interest in efficiency innovation work. Some at times lack knowledge and experience, however. But without this a great deal cannot be accomplished in innovation work."

Technical maintenance unit leader-Communists have thrown their support behind the measures specified by the party buro, measures aimed at improving the quality of job training of young aircraft maintenance specialists. This also places high demands on party members who are in charge of the groups for training young personnel, as well as organization of assistance to individual personnel, plus effective monitoring of the newcomers' development.

Capt Yu. Gayvoronskiy came forth with an initiative calling for reorganization of the training process in a technical study group. Until recently classes were conducted without consideration of differences in the occupational specialties of the attending personnel. The men were for the most part increasing their general knowledge of the design and construction features of aircraft and the rules and procedures of aircraft servicing. But practical realities are demanding increasing specialization. At Yuriy Ivanovich's suggestion, several sections were formed in the study group. Return on study effort has become much greater, and the young men are more and more boldly testing their abilities in innovation inquiry.

Implementing the decisions of the 27th CPSU Congress, the skilled men of this subunit are increasing their efforts in bold innovation. Recently avionics maintenance group technician Sr Lt A. Smirnov devised, for example, a plug connector soldering device for performing aircraft repairs in field conditions. Working together with the group chief, he also came up with a device for testing current relays. This is a specific contribution by aviation personnel toward meeting socialist pledges made in honor of the highest-level forum of our country's Communists. Specialist personnel of other groups as well -- the competition rivals of Gayvoronskiy's group -- are also working hard on their own ideas.

It is necessary maximally to utilize reserve potential for boosting labor productivity in every association, at every enterprise, and at every work station, emphasize the proceedings of the 27th CPSU Congress. It is essential aggressively to campaign to reduce the labor requirements in the manufacture of goods, to reduce work time losses, to adopt the latest equipment and

manufacturing processes, to strengthen order and discipline, to improve the process of determining standards and rates, extensively to employ progressive forms of scientific organization of labor, to boost the level of sophistication of production, and to seek to ensure that workforces become increasingly more stable. The party members of one of the finest subunits in the aircraft training regiment are working these days with a clear awareness of their tasks proceeding from the party's program points. Among these party members are many such as Capt Yu. Gayvoronskiy -- restless, searching, capable of becoming enthusiastic over a new idea and of infecting others with their enthusiasm. By their hard, persistent military labor and innovative attitude to the assigned task, they are confirming in a worthy manner the dedication of the Communists of the 1980's to an outstanding tradition of the warriors of the party of Lenin -- to be at the forefront when things are the most difficult today, where success is determined.

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## GREATER ORGANIZATION, DISCIPLINE DEMANDED OF AIR FORCE COMMAND PERSONNEL

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[Article, published under the heading "Implementing the Decisions of the 27th CPSU Congress," by Honored Military Pilot USSR Lt Gen Avn P. Masalitin, chief, Air Forces Flight Safety Service: "The Aviation Commander: Organization, Competence, Discipline"]

[Text] Intensive combat training is in progress in Air Forces units and subunits. Aviation personnel are conscientiously studying the proceedings and decisions of the 27th CPSU Congress. Commanders, political workers, staff officers, engineers, technicians, tower and command post specialist personnel, and specialist personnel of services and support subunits are working with redoubled energy and enthusiasm to master the equipment and weapons entrusted to their care and are learning to utilize their increased combat capabilities skillfully and effectively. It is very important right now to make every effort to support this strong political upsurge on the part of personnel and to channel it toward achieving new performance levels. The main thing today, state the materials of the 27th CPSU Congress, is fully to mobilize that principal, essentially inexhaustible reserve potential consisting in the human factor, in people, in ensuring a high degree of organization, discipline, and order.

One of the principal factors ensuring the combat readiness of military collectives is the maintaining of rigorous order and organization on the ground and in the air, and increasing discipline and the feeling of responsibility on the part of persons in authority for precise observance of the requirements of documents governing accident-free flight operations. A leading role in accomplishing these tasks should be played by aviation command personnel, who are called upon, jointly with political workers, party and Komsomol organizations, to lead the political and professional upsurge by aviation personnel and to support their initiative and innovative undertakings.

One can scarcely exaggerate the importance of the activities of the one-man commander in the organization and conduct of flight operations. This is dictated by that exceptional role played by flight training in the development of the combat pilot in boosting the military proficiency of aviation subunits

and units, and in ensuring flight safety. Achievement of excellent end results of flight operations is determined first and foremost by how thoroughly the commanding officer himself understands the tasks to be accomplished and the extent to which he has the ability to communicate these tasks to his subordinates in a concise and clear fashion, to distribute manpower and resources in an intelligent, efficient manner. Practical experience indicates that this is done best by those leader-officers who know their men well and who skillfully rely on the support of the party and Komsomol organizations.

...The guards bomber regiment which initiated socialist competition in the Air Forces was conducting routine flight operations. Bombers were taking off one after the other, heading out to the bombing range. Aircrrews were working on complex elements of weapons delivery. Aviation personnel in the air and on the ground were performing smoothly and with precision, and were efficiently utilizing the combat capabilities of the modern aircraft system.

This was fostered in large measure by preliminary work on the part of regimental commander Gds Col A. Labkovskiy, directed toward intelligent, comprehensively substantiated organization of flight operations. Basing his actions on the experience and know-how of his predecessor, Col A. Zemlyanoy, he is displaying innovativeness in planning and organization of flight operations and is constantly seeking reserve potential for intensifying the training process, with rigorous observance of discipline and flight safety rules and procedures.

Today the volume of work involved in organizing flight operations and carrying out the tasks of flight control and safety has increased substantially, while the time available for accomplishing these tasks has decreased. This is due to the greater intensity of air operations and the great complexity of aircraft, weapons, control equipment and facilities. This is why Gds Col A. Labkovskiy devotes the most serious attention to planning. On the eve of the training sorties to the range, in conformity with the month's schedule, he planned out and thought through combat training tasks for the week ahead and determined what should be done on succeeding days, as well as during other days and nights of flight operations. He took as a basis the attained training level of aircrrews and subunits, as well as pilot advance through the training program. The commanding officer went through again, refining and detailing aircraft and support facilities availability and resources, and analyzed the status of alternate airfields and the situation at the range, weather and other conditions. Bearing in mind that the weather is unreliable at this time of year, he assigned the task of readying aircrrews and supporting subunits for flight operations in IFR weather. Taking all factors into consideration, he specified the most expedient flight operations schedule.

The commanding officer and his staff devoted special attention to preparation of a flight operations schedule. The flight operations schedule governs the flight operations shift and is an important indicator of the commander's level of flying methods proficiency. The leader-officer stated the objective of scheduling flights in such a manner as to reduce to a minimum the diversity of training activities being flown. This enabled him more efficiently to monitor progress of flight operations, to direct them in a precise manner, and to

concentrate attention on specific matters of flight safety. The commanding officer also made an effort to ensure that the flight operations shift proceeded with a smooth rhythm, eliminating sharp fluctuations of intensity of flight operations, especially toward the end, when personnel are tiring, while the equipment requires more thorough inspection. This had a positive effect on the course of the day of flight operations. When the weather began to deteriorate, the commanding officer, taking into consideration information obtained by additional weather reconnaissance, promptly made the decision to shift flight operations to another training variation.

And aviation personnel continued performing flawlessly and with precision. The higher commander, who was present during the flight operations and post-mission debriefing and critique sessions, took note of their good organization and the skilled, coordinated job performance on the part of persons in authority, the ATC team, and all aviation personnel.

Unfortunately examples of another, negative kind are encountered in practice. At times one hears from some commanders that daily routine activities take up a great deal of time and that various matters remain unresolved because of this. Experience suggests that this kind of thing happens if people address flight operations scheduling and organization without reasoned analysis. As a result measures are layered one over the other, and efficiency suffers. This happens when there is an inability to predict trends in the subsequent development of events.

A unit commander, who had served as commanding officer of that unit for more than five years, kept himself aloof from direction of flight activities, shoving the entire burden onto his deputies, and took the path of excessive attention to form with consequent detriment to content. He was very sporadic about going up to check his men's flying proficiency, and performed these activities in an unpurposeful manner. This was one of the reasons why a serious accident-threatening situation occurred in the regiment: a pilot touched down short of the runway, damaging his aircraft. The officer was held strictly to account for the quality of his men's training and for observance of rules and regulations ensuring accident-free flight operations.

A most important component of ensuring flight safety is intelligent, reliable control of flight operations. Statistics and analysis of aircraft accidents and near-accident situations indicate that many occur due to serious errors by flight operations officers and other ATC, air operations command and control personnel. In a certain unit, for example, when performing live missile firings at a radio-controlled drone, a wingman mixed up the target radar returns and fired his missile at the wrong target. And the command post operating crew, violating safety regulations in vectoring the pilot, allowed him to close on the target at a time when another fighter-interceptor was positioned ahead of him. It took a promptly executed evasive maneuver by the element leader to prevent a tragic accident.

Reliability of flight operations command and control from the standpoint of flight safety depends in large measure on the ability of flight operations officers to evaluate actual weather conditions and to make a reliable weather forecast. The flight operations officer should have the ability to perform a

thorough analysis of weather conditions together with his immediate superior, and he should have complete and accurate information on takeoff and landing conditions, distribution of cloud layers, and the existence of hazardous weather phenomena. Of considerable importance thereby is correctly and well organized weather reconnaissance and follow-up reconnaissance, which makes it possible to avoid instances of underestimating the seriousness of weather conditions and allowing pilots to go up who are untrained and unprepared for such conditions.

One must have a great deal of knowledge and ability in order to direct flight operations in a knowledgeable and reliable manner. The activities of persons responsible for training officers for air traffic control, flight operations command and control should be directed toward acquisition of the requisite experience and know-how. Practical experience indicates that this work is not everywhere organized properly. As a rule, while senior-level commanders and inspector personnel everywhere conduct rigorous oversight of training of flight personnel, flight operations officers and tactical control officers are frequently left to their own devices.

It is important to arrange things so that training and verification of readiness for flight operations command and control at the airfield and weapons range are as seriously thought through and organized as is pilot flight training. This work should be planned and scheduled taking into account utilization of specialized classrooms and simulators and should be conducted directly at ATC and other command and control facilities work stations.

As the experience of vanguard units and subunits indicates, the establishment and utilization of modern training facilities which meet today's requirements greatly help intensify aviation personnel combat training and help increase the productivity of each and every training hour, each and every minute both on days of theoretical training and during flight operations. And those commanders are correct who devote a great deal of attention to establishing classrooms providing engineering training in all occupational specialties, in order to provide thorough study of aircraft systems and high-quality preparation for flight operations.

We have many units in which the aircraft equipment, practical aerodynamics, and tactics classrooms are outfitted to the level of today's requirements. In these classrooms commanders, pilots and other specialist personnel can not only hold commander training classes but can also prepare for impending flight operations in a high-quality manner.

Many years of practical experience in organizing and running flight operations indicates that the productivity of every flying hour, the effectiveness and safety of every flight operations shift depend in large measure on how solidly observance of regulations and organization have been established in the collective, the degree of demandingness on the part of command personnel, and the militance of party organizations.

The complexity of the combat training tasks performed today by aviation personnel heightens the importance of flight operations discipline as well as

strict, unswerving adherence to flight rules and regulations. In present-day conditions flight discipline has essentially become more substantial, broader and deeper. It is viewed as the basic foundation of flying proficiency. Every pilot should know thoroughly and continuously bear in mind that there are no trivial items in aviation. All erroneous actions and decisions, running counter to established rules and procedures and the requirements of guideline documents, regardless of any good intentions used for justification, inevitably lead to lessened flight safety and ultimately can cause an accident-threatening situation, and sometimes can lead to even more serious consequences.

During visual flight at a height of 200 meters above the terrain, the aircREW of Military Pilot 1st Class Capt Ye. Lesnikov, during daylight and in VFR weather, lost its bearings and, fuel critically low, made a forced landing. And yet neither the helicopter crew's level of proficiency nor the conditions of the flight suggested complications might occur. What happened? It was ascertained that the crew members had been engaged in mission-unrelated chatter, had failed to keep themselves position-oriented, had failed to monitor their flight path, and had failed to record passage over checkpoints. As a result they found themselves in a totally-unwarranted mishap-threatening flight situation.

Rash actions and recklessness are totally intolerable in aviation. Only a high degree of discipline, precision and follow-through on the ground and in the air guarantee the successful accomplishment of missions and a high degree of flight safety. This axiomatic truth has been tested and proven by many years of practical flight experience and is precisely formulated in regulations and manuals. Knowledge and observance of these rules and regulations is the main component of an aviator's discipline and an essential condition for his successful activities.

There is still a great deal of reserve potential for increasing the effectiveness and safety of flying labor, and this potential must be utilized. How can this be done? The Basic Directions of Economic and Social Development of the USSR in 1986-1990 and the Period up to the Year 2000 -- a specific program of action for working people and all Soviet citizens -- state the necessity of general affirmation of the socialist style of economic management, grounded on such Leninist demands of paramount importance as unity of political and economic leadership, a high degree of organization, businesslike efficiency, competence, discipline, and the personal responsibility of each individual for the assigned task. I believe that observance of this provision by commanders, staffs, political agencies, party and Komsomol organizations not only will exert substantial influence on improving the quality of combat and political training but also will help to ensure to a considerable degree that aviation personnel training proceeds at a smooth pace, without interruptions and rush effort to make up lost ground. Organization, businesslike efficiency, and discipline, both on the part of leaders and executing personnel, play a decisive role, especially in the kind of activity represented by flight operations. As a rule results are immediate, and without substantial labor and material outlays. The main thing is to accomplish a psychological reorganization, to develop the desire and ability to think and work in a new way, in conformity with today's demands.

The decisions of the 27th CPSU Congress were met with approval and enthusiasm by the men of the Air Forces. The efforts and energy of commanders, political workers, party and Komsomol activists should be directed right now toward an all-out push to intensify the human factor, to increase organization, businesslike efficiency, and return on labor on the part of each and every member of the team. Improvement of organization of flight training and the conduct of flight operations without accidents or mishap-threatening situations are an essential condition for a high degree of combat readiness and a task of national importance.

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## CARELESS GROUNDCREW HELICOPTER INSPECTION CRITICIZED

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[Article, published under the heading "Advanced Know-How Put Into Practice by Aviation Engineer Service," by Lt Col P. Karpenko and Maj Yu. Kuzmin: "Improving Quality of Inspections"]

[Text] Aircraft inspections are an important part of the squadron engineer's indoctrination activities because, as we know, inspection quality and method of conduct determine in large measure not only the technical state of the aircraft and, consequently, the combat readiness of the subunit and unit, but also instill in the men a sense of personal responsibility for the assigned task, plus other qualities.

In military aviation observance of standards, rules and regulations applying to servicing and maintenance, as specified in guideline documents pertaining to aviation engineer service, is an essential condition for maintaining aircraft in a continuous state of proper working order and readiness for combat utilization. Of great importance is absolute observance of the established system of inspections and performance evaluations. Today's requirements are as follows: not one fixed-wing or rotary-wing aircraft should be allowed to go up without due verification of its technical condition by designated aviation engineer service personnel and flight personnel.

This is also confirmed by the daily practical work activities at the airfield by the majority of squadron deputy commanders for aviation engineer service, who not only organize inspections of aircraft systems in an intelligent, competent manner and on a scientific basis, but also skillfully utilize inspections to instill in the aircraft maintenance personnel under their supervision a strong sense of responsibility for the subunit's combat readiness.

Inspecting on the eve of flight operations a helicopter for which officer I. Surko serves as aircraft technician [crew chief], squadron engineer Maj V. Kuznetsov directed attention to the fact that signs of corrosion had appeared in hard-to-get-at places on some parts.

"Had you noticed this?" he asked the aircraft technician.

"But that is a trifling matter, major. Is it even worth one's attention?" Surko glibly replied.

Of course it is a simple matter to remove corrosion, and Kuznetsov could merely have ordered his subordinate to do so. But the maintenance specialist's complacent attitude rang a warning bell.

"But what if a mounting bracket fails in flight and the control system is lost?" he pursued the discussion.

Surko thought for a moment, and replied in a different tone of voice: "Yes, the consequences could be serious...."

Subsequently inspecting fuel system automatic control devices, Kuznetsov noticed sand near the power valve.

"And what will happen if sand gets into the power valve jet and clogs it?" he further pursued the matter.

"Engine surging," the crew chief replied.

Kuznetsov knew that Surko was no newcomer to aviation. And although he had commenced his tour of duty in the subunit fairly recently, this was no justification for his negligent attitude toward equipment servicing and maintenance in adverse climatic conditions.

This incident was the subject of a serious discussion at a technical critique and analysis session, which was quite frank and to the point for some of those in attendance. The technicians discussed a great many subjects, but emphasis was on the point that when performing inspections one must pay particular attention to so-called trivial items. Spotting and correcting them on the ground is a guarantee of successful equipment operation in the air. Major Kuznetsov also spoke. He told about an incident where aircraft maintenance personnel had carelessly inspected the work station upon completing aircraft servicing procedures. This would seem to be a trivial matter. But it led to undesirable consequences. Aircraft technician officer V. Krylov in turn failed to check the performance of his maintenance people, made the assumption that the aircraft had been thoroughly readied, and therefore limited himself to a cursory inspection. As a result, when the engine was fired up damage was caused by a foreign object which somebody had carelessly left in the air intake.

Following the technical critique and analysis session, Major Kuznetsov assembled the flight technical maintenance unit chiefs and reminded them that in order to accomplish higher-quality inspection it is essential to know in advance what comments on equipment condition had been made and what steps had been taken to correct problems, since this makes it possible to perform inspections in a more purposeful and responsible manner.

After that memorable day, officer Surko drew the correct conclusions and changed his attitude toward inspecting helicopter systems and components. This benefited the inspection and maintenance operation.

As we know, every inspection should begin with checking the preflighting log. This log is a mirror of the state and condition of an aircraft, and in the subunit they rigorously check to ensure that entries are made regularly and filled in correctly. Once when the deputy commander for aviation engineer service was looking through Lt V. Kulik's log, for example, he noticed that the most recent aircraft inspection had failed to turn up any problems. He spoke with the technician and ascertained that the latter had not even inspected the aircraft after flight operations. Kulik replied as follows to the question why this had happened: "Tomorrow is maintenance day, and the aircraft will be thoroughly inspected."

"So this means that you left the aircraft in an unprepared, and therefore in an uncombat-ready state?"

The discussion continued at a meeting of officers. This served as a serious lesson for all, and for Kulik in particular.

A conclusion suggests itself: prompt and high-quality performance of inspections is an essential condition for maintaining aircraft in a combat-ready state, since decisions to perform specific-purpose inspections and additional maintenance work during periods between regular inspection and maintenance are made on the basis of the results of such inspections. This, as they say, is axiomatic. Returning to our discussion, however, I should like to emphasize that the main role in organizing a scientific approach to aircraft inspections in the subunit naturally is played by the squadron deputy commander for aviation engineer service. It is his obligation not only to organize the labor of the men under him but also, as is obvious from the cited examples, regularly to check their level of knowledge and preparedness to perform appropriate maintenance procedures. The main thing -- the subunit's combat readiness -- will gain from this.

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## SNOW SQUALLS HAMPER KOLA PENINSULA MILITARY FLIGHT OPERATIONS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 32-33

[Article, published under the heading "Constant Attention to Flight Safety," by Maj (Res) V. Solodov: "Snow Squalls Over the Airfield"]

[Text] A day flight operations shift was in full swing at an Arctic airfield. It was during the day, but it was as dark as late dusk. A few lonely stars glittered through breaks in the clouds, and a ground wind was sweeping thin strands of snow along the floodlight-illuminated concrete surface.

Flight operations were in progress. It seemed that nothing could disturb the precise, sure rhythm. But the Arctic weather is treacherous. The forecast called for snow squalls during the period of flight operations, and the weather specialists were keeping a constant eye on the situation.

Soon the tower received a report that a snow squall was approaching the field. Immediately, on the flight operations officer's orders, aircraft proceeded to approach and land one after the other, and just in time. The lights across the bay began to wink and fade. A windsquall hit, throwing stinging handfuls of snow into one's face, and everything disappeared in a solid curtain of whirling snow: airfield buildings, runway lights, aircraft on the ramp.

All operations halted, the airfield waited silently. The commanding officer took his time about making a final decision: according to the aviation weather specialists the snow squalls were of brief duration, with long intervals between them, and the radar showed only a few isolated bright areas indicating precipitation. This meant that they could continue operations according to plan, using the intervals between snow squalls for local-traffic operations. But it was necessary to maintain continuous ground radar surveillance of precipitation activity, while aircrews aloft would have to maintain a higher degree of alertness, monitoring weather further out with their airborne radars and radioing more frequent reports to the ground on changes in the weather situation.

The sky over the airfield indeed soon became clear. But the flight operations officer did not immediately give takeoff clearance to the next aircraft in line. Snow squalls are hazardous not only during takeoff and landing, due to

an abrupt worsening of visibility and considerable windshifts, but also during work in the pattern, as a consequence of intensive shaking of the aircraft, electrostatic charging and icing in the snow-charged clouds. In addition, lightning strikes are a possibility when aircraft enter intensive snow-squall zones with a high electrostatic field intensity.

Snow squalls -- brief-duration, extremely heavy precipitation in the form of snow or hail accompanied by violent wind gusts -- are highly dangerous weather phenomena. They are typical of coastal regions of the North and Far East in winter and transitional seasons, and especially of the southern, unfreezing part of the Barents Sea and the northern coast of the Kola Peninsula. Here on the coast snow squalls occur as a rule with a wind from the north.

Snow squalls form in cold air as it passes over an open water surface. Due to water's high degree of heat transfer, the water-adjacent air layer rapidly heats up and becomes saturated with moisture. Cumulonimbus clouds form. Cloud bases are generally at 200-400 meters, but in heavy snow squalls they can drop to the ground (water) surface, with cloud tops at from 1,000 to 4,000 meters.

As it passes over the land, the air cools from the cooled ground surface and becomes stable, losing moisture as a result of precipitation, mixing with continental dry air, and the effect of downward air currents. For this reason snow squalls end at some distance from the shore. Their depth of penetration onto land usually runs 20-50 kilometers.

Snow-squall activity is most intensive when winds aloft are from the northwest. In these instances the cumulonimbus cloud tops extend to 3,000-4,000 and sometimes 5,000-6,000 meters, and visibility can drop almost to zero. Gale winds are a frequent occurrence in these conditions, and thunderstorm activity is also sometimes observed. But snow squalls of this type are of brief duration (10-30 minutes with intervening intervals of like duration), and their intensity drops off rapidly. As intensity diminishes, the duration of snow squalls becomes shorter, while intervals between squalls increase.

When winds blow from the northeast, snow squalls develop in an air mass formed above the Central Arctic and with a strong temperature inversion in the lower part of the air mass. As the air mass passes over a comparatively narrow strip of open water, it becomes unstable only in a thin water-adjacent layer (up to 1,000-1,500 meters thick). In this instance the cumulonimbus clouds do not undergo vertical development, but spread out horizontally under the temperature inversion. Due to the considerable extent of cloud development, snow squalls from the northeast tend to be of considerable duration (up to 2-3 hours), with short intervals between squalls. Visibility during such snow squalls is usually about 1,000 meters, and precipitation is generally continuous.

With winds from other directions, snow squalls appear as intermediate forms between the above-described types.

...In the meantime flight operations at the field were continuing. The sky had completely cleared, the wind had dropped off, and it had grown colder. The only returns appearing on the radar were from aircraft. But the flight operations officer held takeoff clearance, consulted with the duty weather forecaster, and checked with aircrews aloft. One of the pilots reported: "I can see ground fog on low-lying areas in the vicinity of the airfield, and light misting is occurring over the bay."

Well, had the situation changed? It had not. The forming of radiation fogs during snow-squall activity is a phenomenon with which aviation personnel stationed in the Arctic are well familiar. Falling precipitation increases the moisture content of the air. At the same time the wind drops in intervals between snow squalls, sometimes to dead calm, and the clouds may totally dissipate. Radiation fogs form at such times. During the polar night, when daytime warming does not occur, they are usually observed at any time of the day or night. This makes the airman's job even more difficult.

In addition to snow-squall activity, the Arctic is characterized by a high frequency of other complex weather phenomena. Along the northern coast of the Kola Peninsula, for example, which is situated on a boundary between an ice-free sea and a continental landmass which cools off considerably during winter, on the average there are 9-11 days with precipitation with visibility less than 1,000 meters during each of the winter months (November-April), including 5-7 days with snow squalls (especially at the beginning and end of the period), 5-6 days with fog, and 7-9 days with snowstorms. A portion of flying time is spent on preparing runways following abundant snowfalls, heavy snowstorms or ground surface icing.

At times there are so many days where conditions prevent flying that in order successfully to accomplish the combat training schedule it is essential to make maximum use of flying weather, including periods with snow-squall activity. Of course this presents certain hazards. As practical experience indicates, however, flying in such conditions is possible. The main thing is to ensure that aircraft avoid snow squalls and snow-charged clouds. To ensure this, takeoff, landing and pattern work should be done during intervals between snow squalls.

Analysis of the weather situation enables one to reach conclusions on the possible intensity, duration, and periodicity of snow squalls. At times of brief, frequent snow squalls, cross-country and practice-area flight activities can be conducted, as well as in the area of the field with considerable intervals between squalls. Fuel reserve should be sufficient to enable an aircraft to wait out a snow squall aloft or divert to another field.

Analysis of photographs obtained from the USSR Hydrometeorological Center are very helpful in making an overall snow-squall situation assessment. In these photographs convective cloud elements contrast well against the open water surface. The shoreline is clearly visible. This makes it possible to tie in a zone of snow-squall activity to the local area and monitor its movement. Thus one can determine the time of beginning and ending of snow squalls in an area of interest and, with a certain degree of experience, to give a high-quality estimate of squall intensity. As a rule infrared images are used

during the polar night. Nevertheless the principal situation diagnosis and prognosis tool for snow squalls is radar weather reconnaissance. This involves increased-frequency (every 15 minutes) observations of radar returns. It is expedient to transfer the weather picture from the radar display to a special plotting board. Comparison of sequential locations and dimensions of precipitation returns makes it possible to determine the speed and direction of movement of snow squalls and their evolution as they advance. With this data one can calculate to a sufficient degree of accuracy the time a given squall will approach the field and adjust the flight operations schedule to ensure safe flying conditions.

Good flight operations support results in a snow-squall environment are achieved by placing a mobile weather observation post with a UHF transceiver at a point in the direction from which snow squalls are anticipated. The distance from the field at which the post is located is selected so as to ensure that there is sufficient time to take the requisite safety precautions between the moment a snow squall is detected and shutdown of flight operations.

Flawless functioning of a gale-winds warning system is very important during snow-squall activity.

Knowledge by controller and flight personnel of the peculiarities of snow-squall processes, precision organization of airborne weather reconnaissance and follow-up reconnaissance utilizing onboard radars, and a well-conceived system of obtaining information from all crews, utilized together with the capabilities of the weather service, is a guarantee of a high degree of efficiency in utilizing flying time and of flight safety in conditions of snow-squall activity.

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## HISTORY OF AIR-TO-AIR COMBAT REVIEWED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 34-35

[Article, published under the heading "Tactics and Simulation," by Military Pilot 1st Class Col Yu. Kislyakov and Candidate of Military Sciences Col (Res) V. Babich: "History of Aerial Combat"; part 3 of a series; see the January-February 1986 issues of this journal]

### [Text] The Civil War

During those tempestuous days in October 1917, many aviation detachments which were elements of the old army went over to the side of Soviet rule. The counterrevolutionary bureaucrats in the administrative edifice of the Air Fleet Directorate, as well as Mensheviks and Socialist Revolutionaries ensconced in the All-Russian Aviation Council, made every effort to hinder the Bolshevization of aviation detachments. A revolutionary attitude prevailed, however, among engine mechanics, junior aircraft maintenance specialists, enlisted-personnel aerial observers and pilots, who comprised three fourths of combat flying personnel, and therefore they embraced the October Revolution with their hearts and souls and unreservedly entered the service of the young Soviet Republic.

Vladimir Ilich Lenin attached exceptional importance to aviation in performing military and civilian tasks. In order to prevent the counterrevolutionaries from utilizing aviation in their own interests, on the second day of the revolution, 26 October, he issued orders that no aircraft be allowed to take to the air without special authorization by the Military Revolutionary Committee (VRK). On 29 October the 1st Socialist Fighter Aviation Detachment of the VRK, under the command of pilot I. Dudolev, and the 2nd Revolutionary Aviation Detachment of the VRK, headed by pilot A. Labrents, were formed to combat the mutinous troops of Krasnov and Kerenski.

In October-December 1917 measures were taken at the initiative of V. I. Lenin, regulating the military aviation organizational structure and command and control system.

We should note that of the old army's 1,000 aircraft, the Red Air Force of the young Soviet Republic inherited 266 serviceable aircraft, 59 aircraft down for

repairs or overhaul, and 169 at factory storage facilities and aircraft storage depots. Six aviation detachments of 12 aircraft each were reactivated during the first two months following the October Revolution. Subsequently the number of subunits grew steadily, proceeding from the requirements of the Workers' and Peasants' Red Army, and by the fall of 1918 25 aviation detachments were taking part in combat operations. The aircraft fleet was steadily shrinking, however, due to constant breakdowns and accidents, while replacement with repaired and overhauled aircraft was proceeding extremely slowly.

According to available figures, Krasvoyenlety [red military pilots] (Soviet military pilots bore this designation at that time) fought 9 air-to-air engagements from February 1918 to the end of that year, and 32 in 1919. Due to the overall small number of aircraft available, fighters were forced to perform functions for which they were not designed: reconnaissance, artillery spotting, bombing, aerial photography, and liaison, which explains the small number of air-to-air combat engagements. One can scarcely overemphasize this experience, however. It was precisely during this time that the fine traditions of Soviet fighter pilots were born, traditions which were subsequently passed on like a relay baton from generation to generation.

In 1939 former aviation group commander and two-time recipient of the Order of the Red Banner I. Voyedilo wrote: "That which today every Soviet pilot can accomplish was possible during the civil war years, due to a very poor situation regarding equipment, through the display of enormous courage and enthusiasm. Pilots were riding 'flying coffins.' They would fly an aircraft to the point where the fabric would balloon, longerons would come unglued, and engines would give out due to bad fuel. Forced landings were a frequent occurrence. We not only flew reconnaissance, however, but also stood up in aerial combat and put the wood to an adversary who was extremely well equipped and numerically superior." (During the Civil War years the interventionists and White Guardists had 700 aircraft).

The first air-to-air engagement fought by Soviet fighters took place near Sviyazhsk in the fall of 1918. At that time the enemy was stepping up his air activities. Reconnaissance aircraft were flying with impunity over the positions of the forces of the 2nd, 3rd, and 5th armies. Chief of Aviation of the Eastern Front A. Shiukov telegraphed the commanders of these armies' aviation detachments and instructed them to take immediate steps to interdict reconnaissance flights. Several days later he received a report that an enemy reconnaissance aircraft had been shot down in aerial combat. On 7 October Red Military Pilot Baturin and aerial observer Rukhin, from the 5th Army's aviation detachment, spotted an enemy aircraft while returning in a Sopwith from a reconnaissance flight, and the pilot decided to force him to fight. Diving out of the sun, he came up under the adversary's tail to a distance of 10-15 meters, opened fire, and forced him to turn tail and run. After this enemy air activity dropped off sharply.

Flying ground troops cover as well as reconnaissance aircraft and bomber escort missions in 1918-1919, fighter pilots obtained their first experience in organizing air defense of large administrative and industrial centers: Petrograd, Tsaritsyn, Baku, Kazan, and Astrakhan. During the defense of

Petrograd, for example, fighters downed 4 enemy aircraft, working in coordination with antiaircraft artillery.

In the spring of 1919 the 11th Army, which was defending Astrakhan, included a detachment of two Nieuport-XVIIIs and a Sopwith. Since the battle line was situated at a distance of 100-150 kilometers from the city, the White Guard and British 221st Aviation Detachment, based at the airfield at Port-Petrovsk, was using an intermediate (staging) field on the island of Chechen. The de Havilland aircraft had a top speed of 200 km/h and carried 2 machineguns. The enemy flew fairly frequent raids on Astrakhan. The two Soviet aircrews were unable to handle them.

S. M. Kirov, member of the Revolutionary Military Council of the 11th Army, asked Moscow for help. Soon 2 fighter aircraft arrived in Astrakhan by rail -- a Spad XII and a Nieuport-XXIII. They were inferior to the British aircraft in speed and combat capabilities, but arrived red military pilots Anatoliy Korotkov and Daniil Shchekin gave assurances that they could be effectively used in combat.

The time of enemy appearance over the city was not predictable; therefore it was necessary to set up an early warning system. Detachment commander I. Fokin arranged for daily strip alert at the airfield. The city's air defense also included 76 mm guns and air observations posts, which warned of enemy approach with colored signal flares. An air-raid alert in the city was announced with two shots from a cannon situated in the city fortress.

Antiaircraft observation posts spotted enemy aircraft at 10 a.m. on 16 June 1919. The fortress cannon sounded the alert. A. Korotkov, D. Shchekin, and N. Lapsa, on alert duty at the airfield, as the plan prescribed, fired up their engines and took off. Once airborne, the 3 aircraft separated: Lapsa headed over the railyard, where he maintained station, while Korotkov and Shchekin headed off southwestward in formation toward the enemy.

The pilots soon spotted 4 two-seater de Havillands proceeding in a Vee formation at a much higher altitude. The situation enabled them to approach the enemy undetected. Korotkov and Shchekin closed on the enemy without being spotted, but they opened fire prematurely and failed to hit the target.

The enemy aircraft closed formation and continued flying toward the railyard. Prior to arriving at the target, the de Havillands proceeded to alter formation in order to bomb in sequence. Their attack had to be prevented at all costs. Korotkov proceeded to climb in order to launch a second attack, while Shchekin, positioned laterally, advanced out of the sun toward an aircraft which was completing a turn. When he had closed to a distance of 80 meters the pilot, ignoring the fact that the de Havilland's aerial observer had opened fire, squeezed off a long burst of machinegun fire. Its engine damaged, the British aircraft began to lose altitude.

At this moment N. Lapsa arrived on the scene with his Nieuport. Forces were now equal. The enemy aborted his bombing run and turned toward the Volga. The pilot of the crippled de Havilland was able to recover before striking the ground and attempted to rejoin his comrades. Our fighters set out in pursuit.

The enemy then dropped his bombs into the river and, making maximum speed, broke away from the pursuit. The damaged aircraft, however, made a forced landing on the steppe. The British fliers set their aircraft on fire but themselves were taken prisoner.

For this aerial victory Red Military Pilot D. Shchekin was awarded the Order of the Red Banner, while Korotkov and Lapsa received a commendation from the Revolutionary Military Council of the 11th Army.

Combat against balloons was a no less important mission at that time. "These importunate enemy eyes would spend entire days 'probing' our troops' positions and were an effective means of reconnaissance," stated the magazine VESTNIK VOZDUSHNOGO FLOTA [Air-Force Herald]. Upon being assigned the mission to destroy a balloon, pilot Kaminskiy spent two days observing it with binoculars. He noted down the balloon's operating schedule and made a time calculation for his sortie. A mechanic mounted 6 Le Prieur rocket flares on his Nieuport XXI, 3 on each landing-gear strut, and the pilot took a registration shot at a target at a range of 100 meters. Firing was figured for separate firing (2+4) or salvo fire at a 2-second interval. Electric power was obtained from a storage battery placed behind the pilot's seat. In order to lighten the aircraft and maintain its maneuverability, it was necessary to remove the Lewis machinegun with all its mounting hardware. Determining that the balloon had completed its first shift aloft, Kaminskiy climbed aboard his aircraft. He did not have to wait long. About 40 minutes later the balloon again began to ascend. The pilot took off, climbed to an altitude of 3,000 meters in the vicinity of the field, and climbed an additional 700 meters en route. The high altitude was necessary in order to accomplish a "silent," undetected approach. In addition, the plan called for attacking the enemy from the rear, out of the sun. Thus the plan to gain the element of surprise was reinforced with concealment measures.

Turning to his attack heading, the pilot shut off his engine and headed for the target. The balloon, bearing a black Maltese cross against the background of a white circle, rapidly loomed larger as he approached. He aimed on the Maltese cross. When he had closed to approximately 100 meters from the target, Kaminskiy pushed the four-rocket firing contact and pulled back on the stick. The aircraft swept above the gas bag, which was now ablaze, clearing it by about 10 meters. The pilot succeed in restarting his motor at an altitude of 700 meters, under antiaircraft fire, and returned safely to his home field.

Real battles were frequently played out around balloons. In addition to tactics of attack, pilots also employed modes of defense. On 24 September 1919, for example, Red Military Pilot A. Shirinkin, flying a Nieuport-XXIII, engaged 3 enemy aircraft which were attempting to shoot down a Soviet observation balloon. First the pilot attacked the aircraft carrying bombs (the practice of bombing balloons was being followed at that time), after which it attacked from forward and above a fighter which was closing on the balloon. After executing a dive, he proceeded with a climbing maneuver and, banking steeply, swung around onto the adversary's tail. But the White Guardist succeeded in evading the attack with a high-speed descent. The third aircraft withdrew without accepting battle.

A. Shirikin's air-to-air engagement served as a model of skill for the other pilots who were providing air cover to Soviet forces at Dvinsk. The official order awarding the Order of the Banner to this intrepid pilot stated that, thanks to the skilled actions of the fighter detachment, the enemy had ceased aerial reconnaissance and attempts to knock down Soviet balloons in that sector of the front.

We should note that it was no simple matter to destroy a balloon. It required thorough preparation, calculations, and tactical sharpness. Blind-charge attacks ended poorly. On 30 October 1919, for example, while serving as a fort artillery observer, red balloonist V. Konokotin was attacked by an enemy fighter. He caught the pilot in a mistake on his fourth pass and, squeezing off an accurate burst of machinegun fire, sent the enemy aircraft plunging into the Gulf of Finland.

A distinctive feature of aerial combat in 1918-1919 was the fact that Soviet pilots fought air-to-air engagements in the course of performing their principal missions of reconnaissance or bombing. A continuous attitude of aggressive willingness to fight at any phase of a flight and to switch over to a totally different type of combat employment reflected their high degree of professional and psychological preparedness.

Two-time Order of the Red Banner recipient Ivan Iosifovich Petrozhitskiy was distinguished by exceptional flying skill, valor and courage in performing combat missions. His name first appeared in print during World War I. In December 1916 Ensign Petrozhitskiy, flying a Voisin, engaged 6 German aircraft. Two of them were flying forward in trail, while the other four brought up the rear in diamond formation. Concealed against the terrain background, Petrozhitskiy surprise-attacked the lead element. The Voisin knifed between the two Brandenburgs, powered through a 180 degree skidding turn, and ended up under one of them. In that position the adversary was unable to return fire. Aerial observer Bardosh, firing a long machinegun burst, wounded the Brandenburg's second crewman and holed its gasoline tank. The crippled aircraft put down on Soviet-held territory. Its crew was taken prisoner.

Ivan Iosifovich served in the Red Air Force as the Southern Front's deputy chief of aviation. In spite of the high position he held, however, he regularly flew combat missions. He repeatedly encountered enemy fighters in the air, but not once was his aging Voisin shot down. The pilot and his observer skillfully employed battle tactics, devised by Soviet aviators, for a two-seater aircraft against a single-seat fighter, which essentially boiled down to the following: one should never turn and run, even if one's rear is not protected; if the adversary attacks from above, one should not descend -- the best defense is zigzag level flight; when the adversary attacks from below, the best thing is to orbit, firing at him from above (defense in place); one should not allow the adversary to get on one's tail, for which one should execute rapid vertical turns, slips, a steep spiral descent or even spin of two to three revolutions. The machinegun should be fired in short bursts (5-10 rounds) -- continuous, random fire fails to hit the target; any

defense should be immediately accompanied by attack; quickness of decision-making in combat is a sure guarantee of success.

Thus combat success by a two-seater aircraft against enemy fighters depended entirely on the flying, weapons, tactical, and psychological training and preparation both of the pilot, who flew the aircraft, and his observer, who protected the aircraft from attack from the rear. We should state that aerial observers were credited with many downed enemy aircraft and that their names constantly appeared on the lists of persons cited for air victories. For example, the official order awarding pilot Pentko the Order of the Red Banner noted that, engaging in battle with an enemy aircraft, he had downed it due to exceptional courage, skill and presence of mind, while under heavy rifle and machinegun fire. During repeated enemy attacks, he was the first to take to the air and put the enemy to flight, displaying to his comrades an example of selfless performance of military duty. Pentko began his combat career in World War I as an aerial observer. After the revolution many pilots and aerial observers made their contribution to the rout of the interventionist and White Guard forces, to theory and practice of combat employment of aircraft. (To be continued)

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## PROCEDURES FOR APPLYING TO AF SCHOOLS, LIST OF SCHOOLS ACCEPTING APPLICATIONS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 36-37

[Article, published under the heading "To Youth About Air-Force Schools," by Col M. Buchilin: "The Sky Calls the Intrepid"]

[Text] Air Forces educational institutions, performing the task of training aviation cadres, are making a worthy contribution toward strengthening our country's defense capability. The network of Air Forces educational institutions includes pilot, engineering, and technical schools, which train pilots and navigators of all air components, engineers and technicians specializing in maintenance of airframes and powerplants, aircraft armament and avionics, tactical control officers, engineer-weather specialists, and Air Forces rear services specialist personnel.

A young man desiring to dedicate himself to aviation should make a definite decision on what type of specialist he wants to become. Unfortunately it still happens that a young man, who has successfully completed all stages of competitive selection and completed 2 or 3 years of training, reaches the conclusion that he has erred in his career choice. In order to avoid such mistakes, the rules and regulations governing career selection of candidates for military educational institutions of the Ministry of Defense specify measures which enable a young man to choose for himself a military aviation specialty which is truly to his liking and which is compatible with his state of health and personal attributes.

Many schools are quite popular among youths who have decided to become military aviators. One of them is the Order of Lenin and Order of the Red Banner Borisoglebsk Higher Military Aviation School for Pilots imeni V. P. Chkalov. Its history dates from 1923, when the Red Air Force Second Military School was established on the personal instructions of V. I. Lenin. The 10 pilots at the school's first graduation ceremony, held in October 1923, included eminent Soviet pilot Valeriy Pavlovich Chkalov, whose name was conferred on the school in 1938.

In 1933 the school was awarded an Honorary Revolutionary Red Banner by decree of the USSR Central Executive Committee for its excellent results in training flight personnel. It was awarded the Order of Lenin in 1943 in honor of its

20th anniversary and for its success in training combat pilots. In 1945 the school [shkola] was redesignated a military aviation school [uchilishche] for pilots. The Borisoglebsk School has trained tens of thousands of military pilots since its inception.

The school's alumni displayed heroism and skill in aerial combat against the Japanese militarists at Lake Khasan and on the Khalkhin Gol River and against the White Finns on the Northwestern Front. They performed many feats of valor in the skies over Spain. During the Great Patriotic War graduates of the Borisoglebsk School displayed a great many examples of selfless fortitude, courage and heroism fighting for the freedom and independence of our homeland. They added many bright pages to the history of the Great Patriotic War. A total of 262 of the school's graduates were named Hero of the Soviet Union, and 12 of these were twice awarded this honor. School personnel are proud of the exploits of graduates A. Blagoveshchenskiy, A. Vitruk, N. Goryunov, N. Kamanin, A. Mazuruk, A. Alelyukhin, P. Kamozin, V. Kholzunov, A. Yumashev, V. Kokkinaki, and many others. The fame of V. Talalikhin, who performed a night ramming in the skies over Moscow, and of L. Belousov who, after losing both legs, continued flying with prostheses and downed several fascist aircraft in air-to-air combat, will never fade.

The school became a higher educational institution in 1969. It trains pilot-engineers for our country's Air Forces. The school's history is the history of the emergence and development of Soviet aviation. There are many interesting, remarkable things in the history and affairs of other Air Forces educational institutions. From time to time this journal carries articles about them for its readership.

Prior to writing a request or application for acceptance to a military aviation school, one must become thoroughly acquainted with the basic provisions of the rules and regulations which apply. This is very important and necessary because some applicants assume that it will be possible later to transfer to another military educational institution. To put it bluntly, they are profoundly in error. First-year cadets at service schools do not transfer to other schools. Applicants who have successfully completed the selection process and have passed the entrance examinations are enrolled only in that service school for which the board of admissions (field, republic, or school) has accepted them.

Air Forces schools accept warrant officers in active service in the USSR Armed Forces, compulsory-service and extended-service personnel, military construction personnel, civilian youth, military reservists who have completed their active military service, and graduates of Suvorov and Nakhimov military schools with a secondary education. Warrant officers are not accepted to enrollment in aviation technical schools.

The enrollment applicant selection process involves a comprehensive evaluation of the applicant in the following areas: sociopolitical activeness and moral qualities; state of health, taking psychological factors into consideration; physical condition; general educational level. The board of admissions reaches its decision on whether or not to accept an applicant on the basis of

a comprehensive approach, giving weight to all factors in the selection process.

Warrant officers and extended-service personnel must have served at least 2 years as of 1 September of the year of admission. Their age, as well as the age of military reservists discharged into the reserves upon completion of compulsory military service, shall be not more than 23. The maximum age is 21 for applicants who are in compulsory service, military construction personnel, graduates of Suvorov and Nakhimov schools, and civilian youth. Civilian youth applicants must be at least 17 years of age. Age is determined as of 31 December of the year of admission.

Military personnel wishing to enroll in a service school shall submit by 1 May of the year of enrollment a formal application through normal channels with the commanding officer of their military unit. It shall indicate their military rank or grade, last name, first name and patronymic, position held, year and month of birth, education, and name of service school in which the applicant seeks to enroll. The applicant shall append to the formal application personal biographical data, service efficiency report and party (Komsomol) recommendation, certified copies of high-school transcript and birth certificate, and three certified photographs (bareheaded, 4.5 x 6 cm in size).

Civilian youth applicants shall submit an application to the rayon (city) military commissariat in their locality of residence or directly to the commanding officer of the military educational institution in question by 1 June of the year of admission. The application shall state last name, first name and patronymic, year and month of birth, address of residence, and name of the school to which the applicant seeks admission (regardless of whether the given military commissariat has an allocation to this school or not). The applicant shall attach to the application personal biographical data, a character reference from his place of employment or school, a party (Komsomol) character reference, notarized copies of secondary school record (persons currently enrolled in secondary schools, secondary technical schools, and vocational schools shall submit a document of current standing) and birth certificate, as well as three certified photos (bareheaded, measuring 4.5 x 6 cm).

Applicants shall submit their identity card, military service card or residence registration card, original record of secondary education and birth certificate to the board of admissions upon arrival at the school.

Members (probationary members) of the CPSU and Komsomol members shall have in their possession their party (probationary membership) or Komsomol card respectively.

School commanding officers shall inform applicants of the time and place to report for the selection process via military commissariats and unit commanders, who shall issue the applicants documents for free travel to the place where the entrance examinations will be given.

Civilian youths shall take entrance examinations and go through all other parts of the selection process directly at the school to which they have applied. Military personnel shall go through the entire selection process and take entrance examinations with field boards of admissions, as a rule at training course locations in groups of forces and military districts. Applicants traveling directly to the school shall be provided free room and board, according to the standards for compulsory-service personnel, during the selection process period.

Entrance examinations for military higher aviation engineering, flight and navigator schools shall cover the general-curriculum secondary school curriculum in Russian language and literature (written), mathematics, physics, and history of the USSR (oral).

At many schools examinations and examination grading involve the use of computers.

The physical fitness of applicants shall be checked to meet the requirements of individual performance standards of the USSR Prepared for Labor and Defense complex and the military sports complex (100 meter dash, pullup or pullover on the horizontal bar, 1,000 meter cross-country run, swimming).

Psychological testing of secondary-school graduates shall be done according to special methods with employment of tests and equipment which make it possible to determine their psychophysiological aptitude to master the selected area of specialization. Enrollment preference shall be given to applicants who show higher results in this phase of the testing process.

Service-school boards of admissions selection-process applicants between 10 and 30 July.

The following shall be accepted to enrollment in military aviation technical schools, as well as to pilot and navigator schools with psychological testing results to group I, without being tested in the general-curriculum subjects, but meeting all other selection-process requirements (sociopolitical activeness and moral qualities, state of health taking psychological data into account, and physical fitness): Heroes of the Soviet Union and Heroes of Socialist Labor; recipients of USSR medals and decorations (Medal of Valor, Ushakov Medal, Distinguished Service Medal, Nakhimov Medal) for gallantry in action defending the USSR and performing their internationalist duty; Graduates of Suvorov Military and Nakhimov Naval schools; persons graduating from secondary school with a gold medal or from secondary specialized schools with honors.

Applicants for enrollment in higher aviation schools (except for applicants for enrollment in pilot and navigator schools and persons with a group I psychophysiological aptitude rating), persons awarded a gold medal upon graduation from secondary school or persons graduating from secondary specialized school with honors shall take an examination only in the specialization subject, as determined by the service school commanding officer. A mark of excellent on this examination shall exempt them from

further examinations, while with a mark of good or satisfactory they shall also take the examinations in the other subjects.

Students who have completed the first or subsequent years of study at civilian higher educational institutions in specialization areas corresponding to that of the given service school may be admitted to the first year of study at higher and secondary aviation schools without being tested in general-curriculum subjects (but with meeting all other selection-process criteria), following a suitable interview. If subject specialization areas do not match, these applicants shall take examinations according to the general procedures. The chairman of the board of admissions shall make the decision on interview or examinations.

The following shall be accepted to enrollment, exempt from the competitive acceptance process, on the basis of results of the selection process, assuming adequate marks in the general-curriculum subjects: military personnel who have displayed excellent moral-fighting qualities in defense of the USSR and performing their internationalist duty; compulsory-service and extended-service military personnel who are excellent-rated in combat and political training and who have received a commendation at the unit level; compulsory service personnel -- to military aviation technical schools. The recommendation for competition-exempt enrollment acceptance shall be made by selection process boards in the military districts and groups of forces, with due notation on the selection process documents.

The following shall receive preference in admission to aviation schools with equal selection process results: warrant officers with practical work experience in the school's area of specialization, as well as military personnel who are category-rated specialists; worker and kolkhoz farmer applicants with at least one year of work experience; applicants applying for admission on the basis of Komsomol authorizations issued by political departments, rayon and city committees of All-Union Komsomol; applicants scoring higher in the aptitude and psychological testing.

The term of study is 4 years at aviation schools for pilots and navigators, 5 years at engineering schools, and 3 years at technical schools. Students enrolled at service schools are provided full food, clothing and pay allotment, and during their term of study they are given 2 weeks vacation each year and 1 month annual leave. Graduates are commissioned with the rank of lieutenant, are issued a standard diploma, are awarded the appropriate rating and are given a chest badge.

**The Following Are Accepting Applications for Enrollment as First-Year Cadets:**

Red-Banner Armavir Higher Military Aviation School for Pilots imeni Chief Mar Avn P. S. Kutakhov (352900, Armavir, Krasnodar Kray).

Order of Lenin and Order of the Red-Banner Kacha Higher Military Aviation School for Pilots imeni A. F. Myasnikov (400010, Volgograd, 10).

Chernigov Higher Military Aviation School for Pilots imeni Lenin Komsomol (250003, Chernigov, 3).

Order of the Red Star Kharkov Higher Military Aviation School for Pilots imeni twice Hero of the Soviet Union S. I. Gritsevets (310028, Kharkov, 28).

Order of Lenin and Order of the Red Banner Borisoglebsk Higher Military Aviation School for Pilots imeni V. P. Chkalov (397140, Borisoglebsk, 2, Voronezh Oblast).

Barnaul Higher Military Aviation School for Pilots imeni Chief Mar Avn K. A. Vershinin (656018, Barnaul, 18).

Tambov Higher Military Aviation School for Pilots imeni M. M. Raskova (392004, Tambov, 4).

Red Banner Orenburg Higher Military Aviation School for Pilots imeni I. S. Polbin (460014, Orenburg, 14).

Balashov Higher Military Aviation School for Pilots imeni Chief Mar Avn A. A. Novikov (412340, Balashov, 3, Saratov Oblast).

Syzran Higher Military Aviation School for Pilots imeni 60th Anniversary of the USSR (446007, Syzran, 7, Kuybyshev Oblast).

Saratov Higher Military Aviation School for Pilots (410601, Saratov, 1).

Ufa Higher Military Aviation School for Pilots (450016, Ufa, 16, Bashkir ASSR).

Voroshilovgrad Higher Military Aviation School for Navigators imeni Donbass Proletariat (348004, Voroshilovgrad, 4).

Red-Banner Chelyabinsk Higher Military Aviation School for Navigators imeni 50th Anniversary of Komsomol (454015, Chelyabinsk, 15).

Voronezh Higher Military Aviation Engineering School (394064, Voronezh, 64).

Kharkov Higher Military Aviation School of Electronics imeni Lenin Komsomol of the Ukraine (310165, Kharkov, 165).

Order of the Red Banner Irkutsk Higher Military Aviation Engineering School imeni 50th Anniversary of Komsomol 664036, Irkutsk, 36).

Order of Lenin and Order of the Red Banner Tambov Higher Military Aviation Engineering School imeni F. E. Dzerzhinskiy (392006, Tambov, 6).

Red-Banner Kharkov Higher Military Aviation Engineering School (310048, Kharkov, 48).

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## SIGNAL BATTALION ENDEAVORS TO IMPROVE PERSONNEL DISCIPLINE

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 38-39

[Article, published under the heading "The Army's Strength Lies in Discipline," by Col V. Obukhov: "Where There Is Order There Is Success"]

[Text] It was a cloudy, windy day, with intermittent periods of cold rain, turning the unpaved roads into a soupy gumbo of wet snow and thawed peat bog. The signal troops personnel had a difficult march of it that day. It was necessary to tow the special vehicles equipped with radio gear. The men were tired. Inspired with enthusiasm, however, to accomplish the mission assigned by their commanding officer, Maj A. Borisov's men plodded steadily and persistently toward their objective. They were being put to a difficult test of tactical proficiency. Each man knew that after reaching the destination area they would be tasked with providing uninterrupted communications to command authorities and aircrews.

After they arrived at the destination and proceeded with their combat training tasks, additional problems arose. The air became filled with active jamming and atmospheric interference. Subunit commander Maj A. Borisov directed his men's actions with sureness and confidence in this difficult tactical and weather environment. Thanks to his efficient, businesslike competence and high demandingness, as well as the businesslike efficiency of Capt A. Gordeyev, WO A. Rozov and other specialist personnel, the men successfully accomplished all assigned tasks at this exercise.

Following performance evaluation, when the components of success were being discussed at headquarters, the commanding officer placed primary emphasis on the men's professional competence, tactical proficiency, stamina and, of course, efficiency and discipline.

"Without a high degree of organization and discipline on the part of all personnel," he noted, "and without skilled actions, success would have been out of the question. I was firmly convinced that my men would carry out precisely and in a timely manner any orders I issued."

Battalion commander Maj A. Borisov, political worker Maj V. Antonov, and the party activists do a great deal to make their communications personnel into

skilled, disciplined soldiers. Training plans and schedules are unwaveringly carried out in the subunit, firm observance of regulations is maintained, and the men endeavor to carry out assigned tasks with excellent quality. During the winter training period, when totaling up results for the month, the battalion repeatedly scored among the right-flankers in socialist competition conducted under the slogan "We shall implement the decisions of the 27th CPSU Congress, we shall reliably defend the achievements of socialism!" Every other man in the battalion is a vanguard performer in training and a high proficiency-rated specialist.

The men refuse to rest on their laurels, however, but work persistently to improve organization at training classes and drills, and strengthen discipline -- an important factor in high-quality accomplishment of combat training plans and schedules. At one time, for example, one of Capt V. Shirshov's men began committing breaches of regulations and performing poor-quality radio equipment and vehicle servicing. They did not always devote proper attention to training drills, and some specialist personnel did not fully prepare for working on complex drills. And once they received marks below their abilities at a performance evaluation.

How did the commanding officer and party members respond to this? The members of the party committee suggested that the matter of plan discipline be discussed by the party collective. And such a discussion was held. Officers S. Kondratyev and N. Kaydalov as well as other party members made a number of practical, to-the-point suggestions aimed at improving organizational work in implementing the combat training schedule. They devoted particular attention to giving specialist personnel specific assignments pertaining to improving their knowledge of theory and requisite skills. Other measures were also taken, which helped improve the quality of training and strengthen discipline among personnel. As a result of prompt measures and intensified oversight over combat training on the part of the commanding officer and party organization, as well as improvement in methods on working on assigned tasks taking specific conditions into account, they succeeded in correcting the situation in the subunit.

It is to the credit of officer Shirshov's men that they drew the correct conclusions and are completing the winter period of training with good results.

A great deal of credit for this goes to the battalion commander, political worker, and party activists. Their efforts are focused today on improving the performance skill of communications personnel in light of the demands of the the 27th CPSU Congress, on further unifying the military collective, and maintaining in it healthy morale and interrelationships as prescribed by regulations. The content and significance of the proceedings and decisions of this highest-level party forum, the provisions of the USSR Constitution, and the requirements of Soviet laws, the military oath of allegiance and military regulations are explained and clarified to personnel, stressing that they must be carried out to the letter.

Military training films, visual aids, and examples of conscientious observance of regulations by military personnel are extensively utilized for

indoctrination purposes. Specific-topic evening and morning activities, competitions and quizzes for best knowledge of regulations, discussions of feature films and works of literature dedicated to today's life in the military, addresses by military legal specialists, briefings and other mass-political measures aim at precise organization of military service activities and exemplary performance of alert duty by communications personnel.

Maj A. Borisov seeks to ensure that his deputies, the company commanders and sergeant majors, in the process of imposing proper observance of regulations, conscientiously do as prescribed by manuals, regulations and guidelines, refraining from excessively shepherding or doing the job for others. This enables the battalion commander confidently and validly to assign a substantial part of organizing responsibilities to his subordinates. He entrusts highly responsible tasks to his aides, exercising strict oversight and verification of execution.

It is this approach to things which gives the commander, political worker, and other leader-Communists extensive capabilities to maintain firm observance of regulations in the subunit. In these conditions each officer can objectively appraise attained results and look to the future; he is always organized, composed, ready at all times to take effective, immediate steps to prevent departures from the requirements of the military oath of allegiance and regulations.

The following example is typical. Officer V. Demyanenko was known as a knowledgeable and efficient commander. When he took over command of a platoon in the other battalion, however, his new job began with something less than success. One of the young soldiers went AWOL. A similar incident occurred some time later. This took the commander totally by surprise. He had been sure that solid discipline had been instilled in the company. But things were otherwise.

Naturally the guilty parties were punished.

"We must put an end to such things!" the party committee secretary said, turning to Demyanenko. "You supposedly are working on strengthening discipline, but there have as yet been no appreciable changes. Come over to the party committee and we'll talk the matter over."

That evening the party committee room was crowded. Party activists N. Kaydalov, A. Borisov, N. Strukov and others inquired about how Demyanenko was instructing his men and what he proposed to do in the future.

"We cannot let violators of regulations get away with it," said Major Borisov. "But it is not enough just to use disciplinary powers. The community at large must become involved."

"Prior to my taking over as company commander, attempts were made to discuss discipline violators in the company," replied Demyanenko, "but the men showed a poor level of activeness at the meeting. This should not repeat...."

"It is essential to prepare thoroughly for a meeting. We shall help you with this," interjected the deputy commander for political affairs.

The following day Demyanenko summoned party members and Komsomol activists to his office and told them about the discussion at the unit party committee. They then discussed together how best to prepare for a meeting of personnel, how to discuss violations of discipline in a sharper and firmer manner, and how to give guilty parties an assessment by the community. The activists then analyzed the reasons for violations and talked with the men.

There were no indifferent individuals at the meeting that was held soon thereafter. Almost everybody stated his opinion about what had happened. Strong words were spoken against those who were out of step with discipline. Those who had allowed themselves to violate regulations pledged to change their attitude toward their job.

Today the strength and influence of the community is constantly felt in the subunit. Evident first and foremost is the leadership role played by party members. And this has a beneficial effect on observance of regulations, on the men's success in their training, and on strengthening military discipline.

Now the company command authorities and activists are working with success not only with those who had displayed a lack of discipline or had let up in their training. Principal attention was focused on preventing breaches of regulations. Attention is constantly paid to how a given individual is progressing in his training, how he is performing his job-related duties, participating in volunteer work, with whom he is competing, where and how he spends his free time. Youth evenings, debates, discussions about military duty, the honor and dignity of aviation communications personnel, and the demands of communist ethics and morality are organized in the subunit at the initiative of the Komsomol buro.

The men still remember an open Komsomol meeting on the agenda "The Komsomol member is a model of efficiency and obedience." The principal speaker and those who took part in the subsequent discussion spoke admiringly about excellent-rated individuals in training, competition leaders, and stressed their fervent attitude toward their job. At the same time sharp criticism was leveled at those who train and study without enthusiasm, who depart from regulations, and who do not treat their fellow soldiers in a comradely manner. The meeting fostered further uniting of the military collective.

The personal example of the officer, a unity between his word and deed play an important role in maintaining firm observance of regulations. If he says one thing but does another, do not expect good results. This was the case with radio officer Capt A. Grishakov. There was a time when he was cited as an example to others. But the fact is that he sometimes failed to consider the needs and aspirations of his men, and he did a poor job of indoctrinating them. This officer would present reports and conduct numerous talks, but he did not always reinforce his arguments with deeds and personal example.

We should state that this officer had good knowledge of the equipment, the rules and procedures of radio operation, as well as other military guideline

documents. But this is not sufficient for the commander-indoctrinator. He sometimes lacked genuine commander qualities. The command authorities helped Captain Grishakov in a prompt and timely manner to correct his deficiencies and more thoroughly to understand his role as an indoctrinator.

In the current training year the unit command authorities and party organization are working more specifically and purposefully with subunit commanders, seeking to ensure that they are thoroughly familiar with the fundamentals of military education science and psychology and skillfully apply their recommendations in a practical manner. Dissemination of knowledge of Marxist-Leninist theory, CPSU domestic and foreign policy, the new revised version of the Party Program and CPSU Rules is conducted effectively, and the behests of V. I. Lenin pertaining to organization and discipline and the requirements of the USSR Constitution, the military oath of allegiance and regulations are vigorously and aggressively explained.

Battalion deputy commander for political affairs Maj V. Antonov works with political workers and secretaries of company party and Komsomol organizations in an innovative and purposeful manner. He makes an effort to improve their level of ideological conditioning, indoctrinates them in a spirit of unswerving observance of the requirements of the military oath of allegiance, military regulations, and orders by superiors, guided by that point in the CPSU Program which states that confidence in and trust of cadres must be combined with demandingness toward them and an increase in their personal responsibility to party organizations and workforces for work results and for observance of party and government discipline. A leader should be fully responsible for the assigned task, properly establish relations with others, and inspire them by personal example.

Considerable attention is also devoted in this unit to dissemination of legal information and the activities of a regular legal knowledge lecture group. Following are the subjects of just a few of the lectures presented to subunit commanders and activists by people from the judge advocate's office: "V. I. Lenin and the CPSU on Socialist Rule of Law"; "Observance of the Provisions of the Law -- An Important Component in Preventing Violations of Discipline"; "Legal Principles of Organization of the Armed Forces"; "Commander Disciplinary Practices."

The job performance of each commander contains specific features characteristic of that commander alone. But the work style of leading officers also contains many common elements which are mandatory for all. These include first and foremost a firm attitude toward military regulations, their strict observance, and the endeavor at all times to measure up one's actions and deeds to regulations. The achievements of vanguard performers in training and competition, their know-how and experience convincingly affirm that wherever discipline is high and observance of regulations is strong,

there one finds a higher degree of combat readiness and a more unified outfit, and personnel more successfully accomplish their diversified, complex combat training tasks.

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## SHIPBOARD TELEMETRY MONITORING STATIONS

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 40-41

[Article, published under the heading "Space Flight Support," by Candidate of Technical Sciences Col V. Gorkov and V. Drogov: "On the Ocean As on Land"; second part of two-part article; first part appeared in No 1, 1986]

[Text] The principle of operation in mission control, trajectory and telemetry monitoring, and cosmonaut communications is the same as at fixed-site land tracking and telemetry stations. Therefore we shall only address those items which are unique to the vessels of the space fleet.

The most complex and interesting item is determination of the ship's position. It would seem that a maritime navigator service has long been in existence and that no particular problems should be encountered. The problem of determining the position of a shipboard tracking and telemetry station, however, is much more complicated than that of determining the position of a seagoing vessel. And its complexity lies primarily in a different approach to accuracy of determination of position coordinates. While navigators of seagoing vessels are interested in their ship's position relative to surrounding land and sea reference points -- ports, islands, straits, shoaling waters, reefs, and other local features, the navigator of a shipboard tracking and telemetry station must determine the ship's position to a point the coordinates of which are specified in a geocentric coordinate system. But the position of land reference points in a geocentric coordinate system is not always known with sufficient accuracy, and errors of closure can amount to hundreds of meters. Thus it can happen that in a customary navigational sense a ship's position is determined with absolute accuracy, while in the geocentric coordinate system used in theory of space vehicle flight the positioning determination is too imprecise.

Why is greater accuracy required in determining the position of space support fleet vessels? The fact is that all ground services providing space flight support should have a precise and immediate understanding of one another. Therefore, with a large number of the most diversified "proper" coordinate systems, all of them have a common system in content and name -- a geocentric equatorial rotating system. Its origin coincides with the center of the Earth, one of its axes coincides with our planet's axis of rotation, and the

two other axes lie in the plane of the terrestrial equator. High accuracy of determination of a vessel's position affects the accuracy of ballistic computations, and particularly prediction of the motion of space vehicles, that is, the quality of the job they are called upon to do.

Traditional methods of determining position include methods employing compass, direction finder, and rangefinder. Accuracy in tying a ship into geographic coordinates from astronomical observations on the open sea under favorable conditions runs 1-2 nautical miles. Employment of direction finders and radio reference points increases accuracy of determination of a ship's position and is independent of weather and time of day. Nevertheless these methods are employed primarily for preliminary preparation of the work area.

An inertial measuring system is considered to be more sophisticated. It is based on a gyrostabilized platform with accelerometers mounted on it. The platform is placed on a gimbal mount, which provides three-axis freedom and therefore makes the platform independent of the ship's position. The gyroscopes create a coordinate system which is fixed in inertial space. Signals taken from the gyroscopes are applied to actuator motors which hold the platform in an initial position. The accelerometers measure acceleration. The principal element of this device is a sensitive mass which can slip without friction along the axis of sensitivity. Any displacement of this mass from the neutral position indicates a change in acceleration. An electrical signal proportional to displacements of the sensitive mass is applied to an integrator. Since acceleration is a vector quantity, three accelerometers oriented relative to the gyroscope axes will generate three acceleration components, while the integrators will make it possible to determine speed and track. We should note that the accelerometers measure apparent acceleration of the force of the Earth's gravity. In order to obtain overall acceleration (actual speed, path traveled), it is necessary to add to measured acceleration gravitational acceleration for the given point on Earth.

Employment of a satellite navigation system is considered more reliable. The possibility of using space vehicles for navigation purposes became evident back in 1957 during tracking of the first artificial Earth satellite. Experts noted, upon analyzing received signals, that one can extract from figures on Doppler shift of frequencies fairly complete data on a satellite's orbital parameters. Further investigations showed that all the necessary computations can be made from the results of tracking a space vehicle during its passage above the observer. At the same time it was established that it is also possible to solve the inverse problem: to determine the position coordinates of the tracking station on the basis of precise data on orbital parameters. These results initially provided impetus to research and experimentation, and subsequently to the development of satellite navigation systems.

The concept of navigation system presumes utilization of a simple method of measuring the distance between two points on the basis of precise data on the velocity and propagation time of radio-frequency signals. Such a system provides rigorous synchronization of the time of emission of signals from a satellite and accurate measurement of the time it takes these signals to travel to the user's receiving equipment, which contains synchronized oscillators. By multiplying the measured propagation time value by a factor

which takes into account signal propagation velocity, one can obtain a value indicating the distance between the satellite and the user.

Today any such navigation system includes several satellites, a number of control and telemetry system ground stations, and information user points. Let us assume that a satellite navigation system contains six satellites in orbits at an altitude of 1,000 kilometers. For each of these satellites the control and telemetry system computes predicted motion and feeds into the memory of an onboard computer data on the satellite's position or, as specialists call them, ephemerides, tied into precise time signals.

The orbital altitude of navigation satellites is selected from compromise conditions which satisfy accuracy of position determination, flexibility and efficiency of information acquisition, and scale of service. The higher a satellite, the greater the number of users who can be served, and also orbit determination errors introduced by the Earth and its atmosphere are reduced. But an increase in altitude requires a larger number of satellites in order to maintain operational efficiency, for at lower altitudes a satellite's angular velocity is greater, and measurements can be performed sequentially in a single orbit during satellite passage above the observer.

With an increase in altitude, measurements can be made simultaneously on several satellites. Which is better? This depends on the navigation objectives. For seagoing vessels, for example, accuracy of position determination is fully provided with a 1,000-kilometer satellite orbital altitude, while a higher orbit is required for aircraft navigation. It would seem that everything is taken into consideration when designing and operating a space navigation system. Nevertheless the control and telemetry system updates ephemerides every 12 hours on the average, and every 24 hours for the Soviet Tsikada system. Why so frequently?

It is known that a 1 nanosecond error in determining signal propagation time corresponds to an error of 30 centimeters. As practical experience has shown, high-frequency oscillators with crystal stabilization do not possess sufficiently lasting stability. A precision clock employing an atomic standard is required for navigation systems. A cesium standard, for example, provides the required accuracy of navigational measurements for a period of several days, while a hydrogen laser frequency standard provides the required degree of accuracy for several weeks. Basic research aimed at increasing the accuracy of knowledge of geophysical constants is also needed.

But let us return to the question of determining the position of a shipboard tracking and telemetry station. A satellite's ephemerides are stored in an onboard computer, and the satellite transmits them with a constant periodicity in the form of phase-modulated signals together with accurate time signals at frequencies in the 1-meter and 10-centimeter bands. Two frequencies are used to cancel out the phenomenon of refraction of radio waves during passage through the ionosphere, which virtually excludes indeterminacy in accurate measurement of radio wave propagation velocity. The intervals between successive observations depend on the position of the shipboard telemetry station. At the equator communications intervals do not exceed 2 hours, becoming shorter with an increase in latitude.

The position of a shipboard telemetry station can be determined by measuring range to the satellite and the angles describing the direction of the line of sight. A method based on measuring a satellite's radial velocity relative to the ship at several points, however, is presently the most widely employed technique. To accomplish this, the shipboard telemetry station has a radio receiver with a device which measures Doppler frequency, a specialized computer to calculate the ship's coordinates, and a printer to print out information from the computer. Coordinate determination time does not exceed 3 minutes. In addition, by measuring the Doppler shift of satellite signals, a shipboard telemetry station can determine its own speed of movement.

A further increase in accuracy involves first of all the installation of a precision clock at shipboard telemetry stations, synchronized with the satellite onboard equipment. Such a clock could make passive measurements of distance to the satellite and determine its position at the point of intersection of three spheres the center of each of which is the satellite.

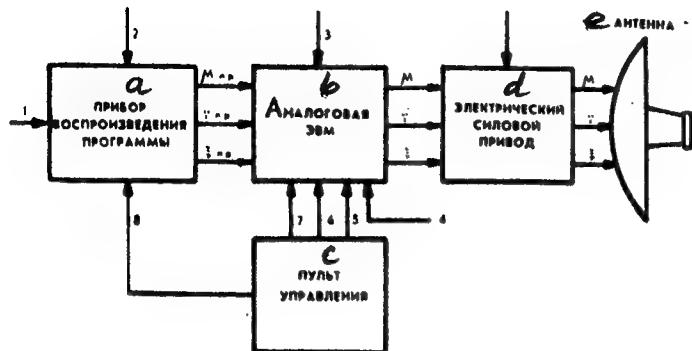
One can also proceed in a different direction, without using a highly-precise clock. For example, provide at least four satellites within line-of-sight of each shipboard telemetry station. Simultaneous receiving of four navigation signals makes it possible to obtain three independent equations of distance differences, which can be used to calculate the point of intersection of the three hyperboloids of revolution which corresponds to the ship's position. The U.S. Navstar navigation system is based on this principle, providing the simultaneous presence of at least six satellites in the user's line-of-sight.

Nature itself is the cause of another peculiarity of shipboard telemetry stations. The ocean's wave action also affects the ship. Wave action causes a ship to describe oscillations on all three axes. Nor does a ship's hull possess absolute elasticity. These factors are absent at fixed-site telemetry stations. For this reason the problem of antenna stabilization and control is incomparably more complex on ships than at land sites. In addition, possible change in ship's heading must also be taken into account.

There are two well-known methods of stabilizing the antennas of modern shipboard telemetry stations, each of which has its positive and negative aspects. In the one instance the stabilization process is incorporated into the antenna control loop, while in the other these processes are independent of one another.

With the first method, the influence of the ocean on the antenna is eliminated with a three-axis design which compensates for roll, pitch, and ship's heading angles. Information for computation of data is stored in a register in the control program reproduction device as well as in a digital computer. When the time marker codes stored in the computer coincide with the common time system signals, the computer proceeds to calculate a given segment of the program, and the following segment is transferred into the register. Thus the orientation program is run step by step. The program-determined angles are fed into an analog computer. Corrections for the ship's rolling and pitching, yaw and actual heading are also fed into this computer. In addition, search and correction signals are fed into the computer, which broaden the antenna's

potential coverage angles. An electric drive mechanism then converts electrical signals into mechanical action on the antenna reflector. The program is initiated from a remote-control panel operator in response to common time system signals.



Key:

- a. Program reproduction device; b. Analog computer;
- c. Control panel; d. Electric antenna drive; e. Antenna

Antenna control diagram

The second method consists in separating the antenna stabilization and control process. The antenna is placed on a platform the position of which is stabilized in azimuth, heel and trim, while control is accomplished in a manner analogous to that described above.

Another function of shipboard antenna control equipment is connected with figuring in corrections for deformation of the ship's hull. During heavy rolling and pitching, the antennas tilt toward one another, and the antenna-turning support axes set perpendicular to the deck cease to be parallel. Hull deformation is measured by a laser or light beam passing down a light conduit under the deck. If the sea is calm, the beam strikes precisely in the center of a target consisting of light-sensitive elements. When the hull flexes the beam displaces, and an electrical signal proportional to the magnitude of deformation is fed into a computer, where it is taken into account in calculating antenna control program angles. We should note that these measurements are taken only for highly-directional antennas. In all other cases it is not mandatory to figure in hull deformation of a shipboard telemetry station.

In conclusion, a few words about communications. The research vessels which ply the waters of the World Ocean are equipped with high-powered shortwave radio gear, used not only for organizing operations with spacecraft and transmitting information received from space, but also for communications with Mission Control Center. If there is no direct communications, communications are handled via other vessels, land telemetry stations, aircraft, and communications satellites.

The ships of the space fleet, born by the launching of the first interplanetary probe and possessing considerable endurance, operate reliably

and for extended periods of time at various points in the World Ocean, performing their assigned mission -- to expand the capabilities of the ground space command, control and telemetry system.

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## HALLEY RENDEZVOUS BY VEGA PROBES DESCRIBED

Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 3, Mar 86 (signed to press 31 Jan 86) pp 42-43

[Article, published under the heading "The Space Program Serving Science and the Economy," by Candidate of Physical and Mathematical Sciences T. Breus: "Toward Halley's Comet"; concluding part of three-part article; see Nos 1, 2, 1986]

### [Text] 3. Waiting For the Encounter

Four unmanned interplanetary probes headed out at the same time toward a distant region in space to a rendezvous with Comet Halley: the Soviet Vega 1 and Vega 2, the European Giotto, and the Japanese Planet A. The Soviet probes were launched from the Baykonur Space Launch Center on 15 and 21 December 1984, the Japanese vehicle was launched in August 1985, and the West European in the summer of 1985. For the first time in the history of mankind, an attempt is being made at direct contact with the most puzzling and variable object in the starry sky, with one of the most famous celestial wanderers -- Halley's Comet.

For what purpose did this race through space begin? Why were space vehicles carrying highly complex equipment on board launched toward Comet Halley? There are a number of aspects to the replies to these questions.

Comets have always excited man's imagination. The word "comet" means "hairy star." In antiquity and in the Middle Ages they were portrayed most frequently in the form of severed heads with streaming tresses. In all ages many peoples have equated the appearance of a comet with misfortune. The history of mankind abounds in wars, epidemics, palace coups, and murders of noble personages, so that it has almost always been possible to ascribe some tragic event to a comet.

Scientifically substantiated hypotheses began appearing in the 18th century. We now know that comets are most likely inhabitants of our Solar System, in which they also probably came into being. The most popular view is that of Dutch astronomer Jan Oort, according to which a "reservoir" exists at the edge of the Solar System, from which a comet escapes from time to time under the influence of the gravitational attraction of nearby stars. If the Sun exerts

considerable influence on it, it acquires a periodic orbit. The orbital period of Comet Halley, for example, is 76 years.

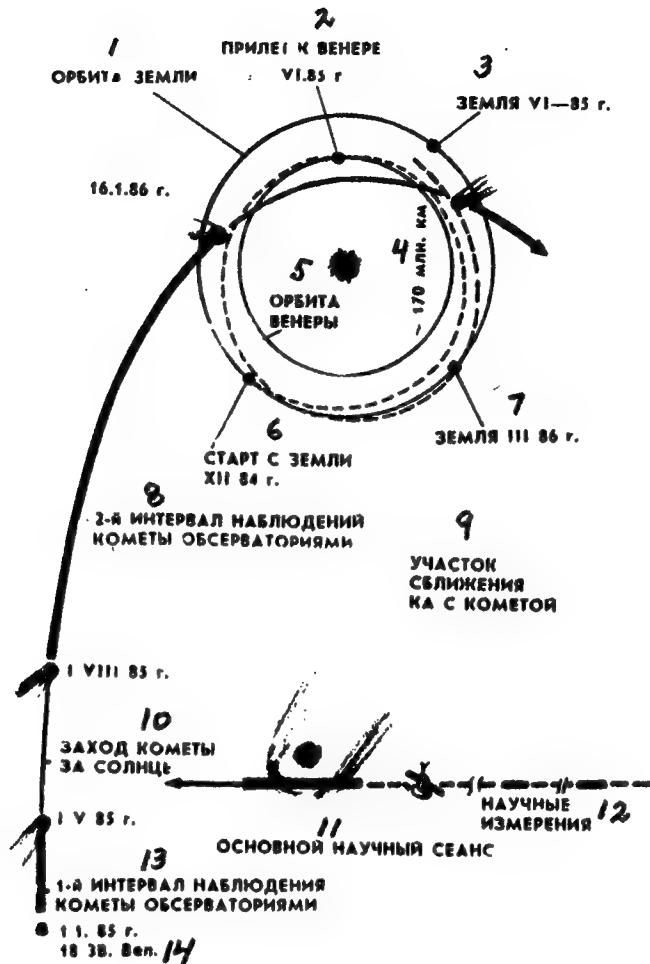
Comets, inhabiting the margins of the Solar System as in a refrigerator, have preserved their primordial state, and apparently consist of that material from which the Solar System was formed. The chemical composition of comets, determined by spectral analysis, indicates that they also contain organic molecules. Therefore many scientists link the question of the origin of life with comets.

Radioactive isotopes with a halflife which indicates that they had entered the cloud of gas and dust from which the Solar System was formed, apparently long before the process of formation began, have been detected in meteorites which have struck the Earth. Their presence is possibly also connected with the explosion of a supernova in the vicinity of the nebula, which "contaminated" it with radioactive elements. This means that the simple organic molecules contained in cometary nuclei were irradiated by isotopes disintegrating due to their radioactivity. Laboratory experiments have shown that such molecules are capable of self-organization and the formation of amino acids and nucleic acid bases -- the building blocks of living matter, which can serve as a foundation for the emergence of the simplest microorganisms.

Since comets could pass in the vicinity of the Earth and even collide with it, it is assumed that our planet could have "become contaminated" by organic matter from comets. These ideas are not undebatable. They are perhaps even dubious. Temperature fluctuations in comets are enormous, since they travel around the Sun in highly-elongated orbits. In addition, the immense energy released during the collision of comets with the Earth would most probably destroy all organic matter. All this must be investigated, however.

Obviously the study of comets is also extremely important for diagnosing physical conditions in interplanetary space. We know that comets constitute a frozen agglomeration of gases of complex chemical composition, water ice and refractory matter in the form of dust and larger particles. They heat up as they approach the Sun. Cometary gases are driven out of the nucleus, carrying solid particles along, and a coma (a brightly-luminous halo consisting of matter flowing continuously from the nucleus) and a long tail form. The diameter of the coma is approximately 100,000-400,000 kilometers. It is so rarefied, however, that light from distant stars, passing through it, experiences almost no attenuation whatsoever.

Cometary tails are always pointed away from the Sun. This is due to the interaction between the comets and solar radiation, both wave and corpuscular. The interplanetary space through which comets travel is filled with the so-called solar wind, that is, a plasma which continuously flows from the Sun -- protons and electrons, which partially carry away the Sun's magnetic field. The high accelerations and the stream structure of some cometary tails are connected with the interaction of ions and electrons in the cometary tail with the solar wind.



Ballistic diagram of encounter between the Vega probes and the comet.

Key: 1. Earth's orbit; 2. Rendezvous with Venus, June 1985; 3. Earth, June 1985; 4. 170 million kilometers; 5. Orbital path of Venus; 6. Launch from Earth, December 1984; 7. Earth, March 1986; 8. Second interval of cometary observations by observatories; 9. Segment of convergence with comet; 10. Comet passes behind Sun; 11. Principal scientific session; 12. Scientific measurements; 13. First interval of cometary observation by observatories; 14. 18th magnitude

Thus missions to comets are very interesting from a scientific standpoint. They are important for studying the basic problems of origin of the Solar System and, consequently, of similar solar systems in our Galaxy, as well as problems of the origin of life in the universe. They are also essential for investigating the properties of interplanetary space.

Academian R. Sagdeyev, director of the USSR Academy of Sciences Institute for Space Research, proposed using unmanned interplanetary probes of the Venera

type for observations of Comet Halley in 1986. This was a very interesting and important suggestion, since its implementation cost much less than separate missions to Venus and to the comet.

The last time Comet Halley passed close to the Sun was in 1910. This was a time convenient for observation. Close to perihelion the comet was positioned between the Earth and the Sun, and the Earth even passed through the comet's immense ionized tail. In 1986 the situation will be unfavorable for observation from our planet. When the comet is close to perihelion, it will be positioned behind the Sun, and it will be possible to see it only during brief times at dawn and after sunset. Venus, however, happened to be close to the comet's perihelion on this occasion. This is why the idea arose to use a gravitational maneuver to send space vehicles toward Comet Halley.

Of course preparation for this unique, multipurpose mission is both difficult and critical. Take just the following question: how can the equipment be protected against damage during passage through the comet's atmosphere? After all, according to plan the probes are to rendezvous with the comet at a distance of only 10,000 kilometers from the nucleus. The density of the cometary dust increases as one approaches the nucleus. It is true that the mass of cometary dust is small, but the velocities with which these particles will be striking the probe are enormous -- almost 80 km/s (the probes and comet will be moving toward one another). These considerations compelled the spacecraft designers to seek reliable means of protection.

The tasks which scientists are hoping to accomplish can be roughly divided into two categories. The first category includes investigations possible from a distance, with the aid of electromagnetic emission detectors operating in the optical, infrared, ultraviolet, and radio-frequency regions of the spectrum. These are classified as remote sensing. The second category includes investigations conducted in direct contact with the comet (contact sensing). It is anticipated that this approach will provide fairly complete answers to many as yet unclear questions of cometary physics.

The package of scientific equipment which can be accommodated on board space vehicles is naturally very limited. Therefore, in spite of what in principle are common scientific goals pursued in the various projects, the makeup of instruments carried by each space vehicle is different. For example, scientific equipment carried by the Soviet Vega probes totals 130 kg, almost three times that of the European Space Agency's Giotto, while the rate of data transmission to Earth is 50 percent greater.

The most unique element in the Vega instrument package is a TV system consisting of two cameras: a narrow-angle high-resolution camera and a wide-angle camera, which will serve as a guidance sensor for the comet rendezvous. The TV system is to detect the comet and its nucleus, provide automatic tracking of the nucleus, as well as transmission of an image of the nucleus with maximum detail to ground receiving stations. The system includes an onboard computer for preliminary processing of images and calculations of coordinates of the cometary nucleus. Photography in different spectral bands will make it possible to synthesize on the Earth a color image of the comet. This system weighs a record-small 31.5 kg.

An automatic stabilized platform is an important part of both Vega probes. All optical instruments are mounted on this platform: a three-channel and an infrared spectrometer, the TV cameras and cometary nucleus guidance sensors. The sensors of the instruments which are to perform contact measurements (dust, charged particles, molecular composition of cometary gases) are positioned on the body of the probe in the direction of the incoming stream of cometary atmosphere. The sensors of the electromagnetic experiment instruments (plasma wave analyzers, magnetometer) are positioned on rods, as far away as possible from the body of the probe. This is done in order to reduce to the maximum extent stray currents (interference) from the probe's metal body.

There is one more peculiar feature of this mission. Usually scientific and useful information is recorded onto a storage device, from which it is transmitted to Earth during communications sessions. It was necessary to depart from this practice, since if cometary dust damages scientific or support equipment (the onboard cable network, for example), this will place the success of the mission in jeopardy. Therefore direct transmission of information to Earth is provided. This naturally required abandoning established technical arrangements. For example, the information density of the supporting radio system, which is responsible for transmitting sensing data to Earth, has been increased by a factor of more than 20. The highly-directional radio antenna will be pointed toward Earth during the entire time of passage through the atmosphere of Comet Halley.

Of course this is only a very brief discussion of the problems and difficulties encountered by specialists in designing the first cometary missions in the history of mankind. Many anxious moments still lie ahead for the people involved in the project. Nobody can accurately predict how events will develop. We do not know whether one of the typical and as yet not understood features -- a shell or envelope, presumably consisting of dust -- will appear and whether it will begin to develop close to the comet and, if so, how the probe will pass through it.

We shall hope for the best. As you recall, to provide insurance against unforeseeable events, the Vega project calls for two redundant vehicles to approach the comet at a one-week interval. A great deal, almost everything, has been provided for. It remains merely to wait. There will be a separate article on the results of the mission.

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## SDI CONDEMNED AS AGGRESSIVE SCHEME

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[Article, published under the heading "Imperialism -- Enemy of Peoples," by M. Aleksandrov: "'Star Warriors' and the 'Business of Death"'; based on materials published in the foreign press]

[Text] Three years ago President Ronald Reagan gave a White House address in which he proposed a so-called "Strategic Defense Initiative" program, which allegedly would guarantee protection against nuclear attack. We might recall that from the end of the 1960's up to the beginning of the 1980's the Pentagon's nuclear strategy was grounded on the concept of "assured destruction," which stated that, with both sides possessing thermonuclear stockpiles, U.S. security was ensured by the capability to deter the potential aggressor from employing nuclear weapons with the threat of inflicting damage on a corresponding or greater scale.

According to the NEW YORK TIMES, the total aggregate arsenal of explosives presently possessed by the United States and the USSR amounts to 15 billion tons. Merely 1/165th of this stockpile would be sufficient to destroy life on Earth and turn it into a planet of "nuclear winter." Apparently on the basis of these estimates, the U.S. President declared the former concept a "great evil" and as an alternative proposed the idea of creating a large-scale antimissile defense system employing the latest technology, including space-based weapons. It essentially boils down to building a space "shield," from behind which a first strike can be launched at any moment. This is the true significance of this provocative concept, which the "star warriors" -- the Pentagon generals and political adventurers -- have so tenaciously seized upon.

Thus the date 23 March 1983 in fact became the starting point of the "Star Wars" Program, as Reagan's "Strategic Defense Initiative" has been so aptly dubbed.

The term "Star Wars" has become for all progressive mankind, for all people of common sense throughout the world, a symbol of sinister U.S. intentions to transform space into a new theater of war, concealed behind the at first glance innocent "wrapper" of defense. Even such prominent military experts as

former U.S. secretary of defense Robert McNamara and J. Smith, former head of the U.S. delegation at the Soviet-U.S. strategic arms limitation talks, have spoken out in condemnation of the Washington Administration's vaunted "Strategic Defense Initiative." They point out that this program is aimed at shattering the existing military balance between the two countries and at undermining fundamental Soviet-U.S. agreements in the area of arms limitation.

R. Bowman, president of the Institute for Study of the Problems of Space and Security, came out even more emphatically on this score. "The systems being developed under the Star Wars program," he states, "are not purely defensive. They will be positioned in Earth orbit, traveling over the territory of potential adversaries and capable of attacking any object in space and, possibly, even on the territory of other countries."

Three years have passed.... The "star warriors" are summarizing results achieved to date at numerous press conferences and congressional hearings. For example, SDI Director James Abrahamson and Gerold Yonas, chief U.S. scientific expert in the field of antimissile technology, noted with unconcealed satisfaction at a press briefing held last year at the Pentagon that Reagan's strategic initiative is advancing "very nicely," at an even faster pace than anticipated.

Specific SDI research areas in which, according to Abrahamson and Yonas, the greatest success has been achieved, include the development of free-electron laser weapons, high-powered ground-based chemical lasers, rail guns, as well as development of methods of compensating for atmospheric disturbances for laser beams and the development of semiconductor materials which are resistant to the effect of radioactive emissions. It is also reported that the decision has been made to speed up the development of space weapons based on nuclear explosions, that is, X-ray lasers.

Recently U.S. SDI research has increasingly gone beyond the laboratory walls. Last year, for example, the first test of the Miracle high-powered laser was conducted in a setting maximally approximating actual field conditions. A ground-based chemical laser destroyed with its beam the second stage of a Titan I rocket at White Sands Proving Ground in New Mexico.

The Space Shuttle Program will also become increasingly more actively involved in SDI. Last June an Air Forces facility on Maui (Hawaiian Islands) aimed a ground-based laser beam toward the shuttle craft "Discovery," which was subsequently reflected back with a prismatic mirror.

Experiments which, in the words of U.S. experts, were "important for SDI," were conducted at the end of July-beginning of August 1985 during the 19th Space Shuttle mission. On four occasions the crew of the "Challenger" briefly fired up the shuttle craft's maneuvering motors for a brief time (from 25 to 45 seconds) while in a ground radar coverage area. As was noted in the U.S. press, such experiments make it possible to determine the potential effect of plasma on laser and beam systems used both for tracking and attacking space objects. A shuttle mission scheduled for the fall of 1987 is to be utilized specifically for the benefit of the "Star Wars" program, while the Pentagon

intends to earmark an additional 14 launches up to the end of 1990 for this purpose.

Work being conducted by the Pentagon on developing the ASAT antisatellite weapon attack system, based on the F-15 fighter, is also closely linked to SDI. It was tested in January and November 1984, and on 13 September of last year it destroyed a U.S. satellite which had ended its useful life.

As additional information and details are learned, the Reagan "Star Wars" program is increasingly perceived as a creature of the U.S. military-industrial complex, with the aid of which the U.S. "business of death" is linking its hopes for a source of profits of unprecedented scale and a guarantee of its prosperity right up to the next century. The journal NATION noted rather aptly that millions of dollars for research in the area of SDI, the alleged purpose of which is to protect the United States against thermonuclear weapons, are ending up in the pockets of those same corporations which manufacture such weapons.

Supporters of SDI are hastening to create conditions favorable for "Star Wars" and a powerful nucleus of SDI-committed companies, research centers and even universities in order to exert pressure on Congress to appropriate more and more funds to carry out the program. Suffice it to say that in 1985 alone the Pentagon's "star warriors" awarded approximately 1,000 contracts to 260 U.S. companies and laboratories totaling in excess of 1 billion dollars. The biggest "Star Wars" contractors include Boeing, Lockheed, and Rockwell, each of which, according to the figures of the Federation of American Scientists, has been awarded Pentagon contracts totaling 200 million dollars or more.

The appetite of the Pentagon and the military-industrial complex is growing. Congress has already approved 2.7 billion dollars in appropriations for Fiscal Year 1986, while by 1989 the cost of SDI projects will reach 50.8 billion dollars, including other expenditures, and 90 billion dollars by 1994. According to estimates, total expenditures on SDI will run from 500 billion to 1 trillion dollars.

According to the figures of the New York Council on Economic Priorities, in 1984 approximately 5,000 U.S. scientists, engineers and other specialists were employed in SDI projects, while the council projects that by 1987 the total will reach 18,600. The Pentagon's "star warriors" and big capital are endeavoring firmly to "program" SDI, to give the program a directional thrust whereby it will be impossible to bring it to a halt. U.S. arms manufacturers have reached the conclusion that their future lies with the "Star Wars" program.

At the present time SDI is limited for the most part to basic research. In the not too distant future, however, U.S. industry, in the opinion of many experts, will proceed from research to weapons development. And "Star Wars" could require weapons deployment on a scale the likes of which nobody has ever imagined. "If things go as far as deployment, this will be the biggest operation of all time for this industry, considerably exceeding everything that has gone before," stated finance expert (A. Benasuli). Figuratively

speaking, the death-dealing locomotive carrying pushers of the "Star Wars" concept is picking up speed.

Sober-minded people throughout the world realize that the nonexpiring treaty between the USSR and the United States limiting ABM systems, signed in Moscow on 26 May 1972, could be placed in question. And what does the White House think about this?

In recent months Ronald Reagan's arms control advisers have been engaged in a fierce debate over whether the President's proposed "Star Wars" program constitutes a breach of the 1972 treaty. The debate was ended by a statement by recently-retired presidential national security adviser R. MacFarlane, which was later confirmed as official Washington policy: "The development of a new generation of laser and particle-beam weapons is permissible, with only deployment prohibited by the terms of that treaty." Thus this is a policy of preparing the soil for a new interpretation of the ABM Treaty, an interpretation which virtually allows unlimited "tests" and "development" within the framework of the "Star Wars" program. And yet statements made in 1972 by the U.S. delegation at the talks and subsequently repeated by the Nixon, Ford, Carter, and Reagan administrations declared that "testing" and "development" of future ABM systems based on lasers and other nontraditional space-based hardware are restricted by the provisions of the ABM Treaty.

The Soviet Union has stressed repeatedly that the SDI Program, including its so-called research component, constitutes a new, even more dangerous round of the arms race, which will inevitably lead to exacerbation of Soviet-U.S. relations.

Last November CPSU Central Committee General Secretary Comrade M. S. Gorbachev stated bluntly at a press conference in Geneva that the "Star Wars" program not only winds up the arms race another notch but also will end any restraint of this race. If the United States finds the will and resolve to rethink and reevaluate all the pernicious aspects and consequences of the "Star Wars" program, the way will open up for constructive solution to the problems of international security and a cessation of the arms race.

There is hope in the Soviet Union that the final word by the U.S. side has not yet been stated in this regard and that peace-seeking reason will prevail. All people of conscience throughout the world and all progressive mankind have faith in this, for to them peace means life, the further flourishing of society, and faith in the future.

At the same time Comrade M. S. Gorbachev stressed at a get-together with a delegation from a congress of Nobel Prize recipients held at the end of last year that if the United States, in spite of everything, proceeds with the

development, testing and deployment of a multilayered antimissile defense, the USSR will find an effective response which is in conformity with our view on the requirements of maintaining the strategic balance and its stability.

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